A SYNOPSIS OF THE MEXICAN AND CENTRAL AMERICAN SPECIES OF *VACCINIUM* (ERICACEAE)

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ABSTRACT

A synopsis is presented with a key to and descriptions of the 27 species of *Vaccinium* occurring in Mexico and Central America, together with their synonymy and a citation of representative specimens. Two species are described and illustrated here as new: **Vaccinium campanense** Wilbur & Luteyn and **V. chihuahuense** Wilbur & Luteyn.

RESUMEN

Se presenta una sinopsis con claves y descripciones de las 27 especies de *Vaccinium* que se encuentran en México y América Central, también se presenta su sinonimia y se citan ejemplares representativos de estas especies. Se describen y se ilustran aquí dos especies como nuevas: ***Vaccinium campanense*** Wilbur & Luteyn y **V. *chihuahuense*** Wilbur & Luteyn.

INTRODUCTION

The representatives of the genus *Vaccinium* in Mexico and Central America were most recently treated by Sleumer (1936) in a study with the deceptively modest title of "Die Arten der Gattung *Vaccinium* L. in Zentral- und Südamerika." Sleumer's account actually covered the species of both the West Indies and Mexico as well as those occurring in Central and South America. Sleumer recognized 30 species in his treatment, but of these only 12 were known from Mexico and Central America. The present synopsis includes 27 species from Mexico and Central America, which gives some indication of the rich yield resulting from the more intensive field work that has taken place within the region in the past seven decades. More than half of the Mexican and Central American species of *Vaccinium* have been described in the most recent three decades, while only four species (or about 15%) were named in the first seventy-five years of the twentieth century and nine species (or 33%) during the nineteenth century.

Perhaps something should be said about the generic concept adopted in the present study. The generic limits are very broad and inclusive like that of Sleumer (1936) in his treatments of the West Indian, Mexican, Central American, and South American members of the genus, as well as his survey of the genus *Vaccinium* (1941) throughout its total range. In the latter paper Sleumer recognized 33 sections in the genus *Vaccinium*, which clearly demonstrates the great morphological diversity that the conservative concept of *Vaccinium* s.l. accepted. As someone whose initiation into Botany was through Small's *Manual of the Southeastern Flora* (1933), the senior author was exposed to a much narrower concept of genera. In the case of vaccinoioid genera such as *Batodendron* Nutt., *Polycodium* Raf., *Herpothamnus* Small, *Oxycoccus* Hill, *Hugeria* Small, and *Cyanococcus* Rydb., they still appear to demark natural groups biologically meaningful as genera than submerged into the vast diversity of the genus *Vaccinium* s.l. However, traditional generic concepts were recently followed by the authors (Luteyn & Wilbur 2005). Molecular data is sparse at present, but it is beginning to be helpful in sorting out some of the relationships within the tribe Vaccinieae (see Kron et al. 2002). Molecular evidence available from Kron et al. (2002) and Powell and Kron (2003) strongly suggests that the genus *Vaccinium* is polyphyletic and hence unnatural; vander Kloet (2004) and Stevens et al. (2004) are also of this opinion. Kron et al. (2002) concluded, however, that a much more thorough molecular survey must be completed before any formal nomenclatural changes could be made. Their prognosis for *Vaccinium* is ominous for those who were content with the heterogenous genus of 33 or so sections. Their molecular survey so far suggests that

"*Vaccinium* will need to be enlarged to include all species currently recognized in the tribe Vaccinieae, or to be broken up" (Kron et al. 2002). Their first alternative would seem to be biologically unsound, because the resulting "*Vaccinium*" would contain so many and biologically diverse groups as to be meaningless; so we are left with the second possibility. Fortunately, Kron et al. (2002) agreed that a vast amount of work, both morphological and molecular, needs to be done before anyone should contemplate how the diverse tribe of several hundred species might best be redistributed. It seems certain that some of those groups to be recognized may be those identified by Small and others a century or more ago. We also feel that the recognition of the Central American greenish-flowered vacciniums into the genus *Symphysia* as seen by Vander Kloet et al. (2004) is premature.

We believe that a morphologically-based and field-oriented synopsis of the genus *Vaccinium* s.l. in Mexico and Central America may prove useful as a working hypothesis as botanists strive to achieve a more natural classification. Hence, this synopsis of the Mexican and Central American *Vaccinium* is presented in the hope that a new species-oriented base line will prove to be a useful summary of what is now known about the genus *Vaccinium* in the extensive and biologically interesting region of Mexico and Central America.

The newly described taxa strongly suggest that additional collecting is still very much needed. The erroneous impression exists that most of the thousands of new species that are described as new each year are present in abundance in our herbaria and that diligent general collecting is no longer needed. The species of *Vaccinium* described in the past half century—and that genus clearly is not exceptional in this regard—certainly demonstrate that all or nearly all of the newly described species are the result of material collected since Sleumer's treatment appeared and definitely are not due to the failure of Sleumer or others to make full use of the specimens available to them. A compelling case can be made that what is still needed is a well-planned, intensive collecting campaign throughout much of the area.

VACCINIUM L.

Shrubs or rarely trees, often rhizomatous, sometimes arising from lignotubers (=burls). Leaves alternate to pseudo-opposite, deciduous or briefly persistent (i.e., barely through the first unfavorable season) or persistent and evergreen, petiolate, the blades with margin entire to (slightly) serrate, the venation pinnate or plinerved. Inflorescences terminal or axillary, racemose, corymbose, rarely paniculate, or 1–2-flowered; floral bract 1, subtending each pedicel; pedicels articulate or rarely continuous with calyx; bracteoles 2. Flowers 4–5-merous, without odor; calyx synsepalous, the tube usually cylindric to globose, the lobes rarely obsolete; corolla sympetalous, aestivation imbricate, valvate or rarely open, cylindric, urceolate, globose or campanulate, white to pink, greenish or yellowish-green; stamens 8 or 10(–12), equal, included or exserted, the filaments equal, distinct or weakly connate at base, equal to or longer or shorter than anthers, the connectives lacking disintegration tissue, spurs on filaments present or lacking, sometimes with apparently vestigial spurs, the anthers equal, lacking awns, the thecae surfaces smooth or papillate, the anther tubules 2, distinct or rarely shortly connate at base, dehiscing introrsely (sometimes obliquely), latrorsely or terminally by pores or clefts; pollen grains in tetrahedral tetrads, lacking viscin strands; ovary inferior, 4–5 (or falsely 8 or 10 by partial partitions)-locular; style included or rarely slightly exserted, glabrous, the stigma small, simple or somewhat capitate. Fruit a berry, crowned by the persistent calyx lobes and capped by the conspicuous nectariferous disc; seeds many, sometimes with mucilaginous sheath.

Vaccinium is a genus with approximately 450 species distributed in the Northern Hemisphere, Mesoamerica, the West Indies, South America, E. Africa and Madagascar, Malesia, and Pacifica. Twenty-seven species from Mexico through Panama are recognized here.

KEY TO THE MEXICAN AND CENTRAL AMERICAN SPECIES OF *VACCINIUM*

1. Calyx continuous with the pedicel (i.e., lacking a disarticulation groove); corolla open just prior to anthesis or closed.
 2. Anthers conspicuously exserted beyond the corolla tube; corolla open prior to anthesis, considerably expanding and enlarging thereafter; anther spurs present _____ **1. V. kunthianum**

2. Anthers clearly included within the corolla tube; corolla closed before anthesis; anther spurs present or lacking.
 3. Erect, terrestrial shrublet arising from a subterranean, slender, woody rhizome; anthers spurred; corolla white to pinkish, 4–6 mm long, 5-lobed; leaves minutely serrate, deciduous or briefly persistent (i.e., barely through the first unfavorable season) ____ **2. V. geminiflorum**
 3. Creeping, viney, epiphytic shrublet; anthers lacking spurs; corolla red, 7–10 mm long, 4-lobed; leaves entire, persistent, evergreen ____ **3. V. dissimile**
1. Calyx articulate with the pedicel (i.e., marked by a conspicuous disarticulation groove); corolla closed prior to anthesis.
 4. Anthers spurred; leaves serrate or indistinctly crenate-serrate.
 5. Fruit in cross-section clearly falsely 10-locular; plants of Mexico and Guatemala.
 6. Inflorescences racemose with rachises (1.5–)5–9 cm long, mostly without floral bracts or only with small, subulate, deciduous bracts; corolla 3–6 mm long, campanulate to urceolate or cylindric; leaves lanceolate to lance-oblong to ovate, 12–26 mm broad; veins on the upper surface of the leaves either not or only indistinctly elevated; nectariferous disk glabrous ____ **4. V. leucanthum**
 6. Inflorescences with flowers either solitary in axils of large, leafy floral bracts **or** in racemes with rachises (1.5–)3–6 cm long with large, leafy, persistent, floral bracts; corolla 5–7 mm long, cylindric to urceolate; leaves lanceolate to lance-elliptic, (4–)8–12(–15) mm broad; veins on the upper surface of the leaves mostly pronouncedly elevated; nectariferous disk glabrous to short-pilose ____ **5. V. stenophyllum**
 5. Fruit in cross-section 4-locular not falsely 10-locular; plants of Costa Rica and Panama ____ **6. V. consanguineum**
 4. Anthers lacking spurs; leaves entire or minutely serrate to crenate-serrulate.
 7. Leaves marginally crenate to very clearly crenate-serrate or minutely glandularly serrulate.
 8. Leaf-blades basally broadly cordate, mostly 2–5 cm broad ____ **7. V. cordifolium**
 8. Leaf-blades basally acute to rounded, mostly less than 2 cm broad.
 9. Leaves glabrous on both surfaces, 8–15 cm long and 4–8 cm broad; leaf venation prominently reticulate ____ **8. V. breedlovei**
 9. Leaves glabrous to densely pilose on both surfaces, (0.4–)1–4.5(–7.5) cm long and usually less than 2 cm broad; leaf venation indistinct to moderately reticulate.
 10. Leaf surfaces densely pilose.
 11. Leaf-blades elliptic to ovate-elliptic, 1–1.5 cm long and 3–8 mm broad; petioles 1–2 mm long; corolla 3.5–5 mm long. ____ **9. V. chihuahuense**
 11. Leaf-blades oblong to lanceolate, 3–4.5(–7.5) cm long and 0.8–2(–3) cm broad; petioles 2.5–8 mm long; corolla 8–10 mm long ____ **10. V. lundellianum**
 10. Leaf surfaces glabrous or very nearly so except possibly in the vicinity of the petiole-blade junction.
 12. Coroila tube densely pubescent externally.
 13. Corolla aestivation imbricate, the tube 5–7.2(–9) × 3 mm, glabrous to pilose externally, glabrous internally; leaves lacking basal glands on lower surface; surface of anthers minutely papillose; forested slopes from 1600–3200(–3700) m in southern Mexico southward into Honduras and El Salvador ____ **11. V. selerianum**
 13. Corolla aestivation valvate, the tube 8–13 × 4–6 mm, densely pilose externally, moderately pilose internally; leaves with 1–2 circular basal glands on lower surface; surface of anthers smooth; forested slopes and páramo from 2500 m and above on Cerro Chirripó, Costa Rica ____ **12. V. talamancense**
 12. Corolla tube externally glabrous or at most with a few scattered trichomes.
 14. Pedicels 7 mm long or less; calyx lobes 1.5 mm long or less.
 15. Leaf-blades mostly over 2 cm long.
 16. Racemes 5–16-flowered, the peduncle/rachis arising from the axils of subtending foliage leaves or from subtending leaf scars, mostly (1.5–)5–9 cm long; corolla broadly campanulate to urceolate or cylindric, 3–6 mm long; berry clearly falsely 10-locular ____ **4. V. leucanthum**
 16. Racemes 6–12-flowered with the peduncle and rachis together mostly 0.3–1.2 cm long; corolla cylindric, 5–9 mm long; berry 4–5-locular ____ **11. V. selerianum**
 15. Leaf-blades mostly less than 2 cm long.
 17. Corolla cylindric, 5–6.5 mm long; Costa Rica ____ **13. V. floribundum**
 17. Corolla cylindric to cylindric-campanulate or cylindric-urceolate, 4–6.5 mm long; Mexico, Guatemala, and Honduras ____ **14. V. confertum**
 14. Pedicels (8–)12–14 mm long; calyx lobes ca. 2 mm long ____ **15. V. wilburii**

7. Leaves entire.
 18. Calyx basally closely subtended or even slightly clasped by 2 broad, rounded bracteoles; pedicels shorter than the flowers; corolla bright red ____ **3. V. dissimile**
 18. Calyx not closely subtended by slightly clasping bracteoles; pedicels much longer than the flowers; corolla not red, but rather often yellowish- or creamy-green.
 19. Secondary and tertiary leaf veins strongly elevated beneath forming a coarse reticulum.
 20. Petioles 5–9 mm long; calyx lobes 5–6 mm long, conspicuously nerved; filaments ca. 3 mm long ____ **16. V. jefense**
 20. Petioles 2–4 mm long; calyx lobes 1–1.2 mm long; filaments 2–2.5 mm long ____ **17. V. furfuraceum**
 19. Secondary and tertiary leaf veins together neither strongly elevated nor forming a pronouncedly elevated reticulum.
 21. Calyx limb saccate, 5(–10)-spurred opposite and below each lobe ____ **18. V. luteynii**
 21. Calyx limb terete and unlobed.
 22. Calyx lobes (1.8–)2–5 mm long.
 23. Leaves conspicuously bullate, the bases ± clasping, the apices rounded; calyx pilosulose ____ **19. V. bocatorense**
 23. Leaves flat not bullate (sometimes concave in *V. monteverdense*), the bases clearly not clasping, the apices acute to acuminate; calyx glabrous.
 24. Corolla internally densely floccose with a dense tangle of white, villous trichomes; anther tubules ca. 1–1.2 mm long ____ **20. V. floccosum**
 24. Corolla internally glabrous; anther tubules ca. 3–5 mm long.
 25. Lower leaf surface glabrous; petioles 4–8 mm long, glabrous or nearly so; pedicels and rachises glabrous; calyx tube 4.5–8.5 mm long; calyx lobes 2.5–3.5 mm long; anthe tubules 4.8–5 mm long, pilose along inner surfaces ____ **21. V. monteverdense**
 25. Lower leaf surface moderately beset with minute puberulence; petioles 3–4 mm long, minutely puberulous; pedicels and rachises puberulous to short pilose; calyx tube 2–3.5 mm long; calyx lobes 4–5 mm long; anther tubules 3–4.6 mm long, glabrous along inner surfaces ____ **22. V. campanense**
 22. Calyx lobes 1.5 mm long or less.
 26. Corollas cylindric to cylindric-campanulate, (5–)8–12 mm long, glabrous internally; staminal filaments noticeably shorter than anthers, the anther tubules 3 mm or longer.
 27. Petioles 1–4 mm long; corollas 8–12 mm long and 6–10 mm in diam. ____ **23. V. poasanum**
 27. Petioles 6–15 mm long; corollas 5–9 mm long and 4–6 mm in diam.
 28. Leaf venation plinerved; calyx lobes 0.2–0.4 mm long or less; corollas pale green to white; anther tubules dehiscing by terminal pores ____ **24. V. almedae**
 28. Leaf venation pinnate; calyx lobes ca. 0.6 mm long or longer; corollas light pink or greenish-white; anther tubules dehiscing by elongate, latrorse clefts ____ **25. V. santafeense**
 26. Corollas cylindric to urceolate, 5–8 mm long, pilose internally; staminal filaments about equaling anthers or slightly shorter, the anther tubules less than 2 mm long.
 29. Leaf-blades basally acutely tapering to rounded; calyx lobes 1.2–1.8(–2) mm long ____ **26. V. costaricense**
 29. Leaf-blades basally rounded to more typically cordate and amplexicaul; calyx lobes 0.8–1.2 mm long ____ **27. V. orosiense**

1. Vaccinium kunthianum Klotzsch, Linnaea 24:56. 1851. TYPE: based on the accounts of HBK (1818) and Dunal (1838) cited below. *Polycodium kunthianum* (Klotzsch) C.B. Rob., Bull. Torrey Bot. Club 39:559. 1912.

Vaccinium stamineum L. var. *ß* Kunth in H.B.K., Nov. Gen. Sp. Pl. 3:267, t. 253. 1818. TYPE: MEXICO. HIDALGO: "in sylvis Mexicanis, inter Pachuca et Real del Monte, alt. 1420 hex," *Bonpland s.n.* (HOLOTYPE: B†; LECTOTYPE, designated here: P-H&B). The specimen of var. *ß* (=*V. kunthianum*), which is in the Humboldt and Bonpland herbarium in Paris (P-H&B), is herewith designated as the lectotype; it is without collection number. There is also at P another sheet annotated by Sleumer in 1958 as an ISOTYPE of *Vaccinium kunthianum*; it has the collection number of *Bonpland 4079*. The Ericaceae at Berlin (B) were all destroyed during World War II. The Field Museum neg. 9020 of the B type shows a sheet with a hand-written label that gives the locality as "in sylvis Mexicanis prope Real del Monte" and the collection number as "*Bonpland 4074, 4079.*" The photo also shows two plant specimens, perhaps the one on the left is "4074" and the one on the right "4079," but there is no way to tell. The type fragment at F has the collection number as "*Bonpland 4079.*"

The Ericaceae types of the Willdenow Herbarium (B-Willd.) include a specimen "America meridionalis, leg. *Humboldt & Bonpland s.n.*" (B-Willd. 8312-1), which has a label written by Klotzsch "*Vaccinium Kunthianum* Kl." This is probably an isotype, but does not have a Humboldt & Bonpland collection number associated with it.

Vaccinium elevatum Banks & Solander ex Wikst. var. *ß* Dunal, DC. Prodr. 7:568. 1838. TYPE: same as for *V. stamineum* var. ß above.

Terrestrial *shrubs* (1–)1.5–10 dm tall; branchlets densely and softly pilosulous or puberulent, the trichomes throughout usually slender and hyaline but occasionally some gland-tipped. *Leaf-blades* deciduous, membranous, elliptic to oblong-elliptic or ovate-oblong, 1.5–3.5(–6.5) cm long, 5–12(–2.2) mm broad, apically acute to rounded, basally acutely tapering to rounded, marginally entire and sometimes strongly revolute, densely spreading pilosulose on both surfaces or glabrate, the venation pinnate but only the midrib conspicuous above, although the lamina also somewhat pustular above, all nerves raised and conspicuous beneath; petioles ca. 1–2.5 mm long, subterete but narrowly canaliculate above, densely puberulent or pilosulose as branchlets. *Inflorescences* axillary, of often leafy racemes, 3–8-flowered; rachises sharply angled, 4–34 mm long, pubescent as branchlets; floral bracts leaf-like to leafy, persistent, elliptic, acute, 5–15 mm long, glabrous to pilosulose abaxially; pedicels 5–6 mm long, sometimes nodding, pubescent as branchlets; bracteoles basal or near base, linear to oblanceolate, ca. 1.5–3 mm long, hirsutulous. *Flowers* 5-merous; calyx ca. 2.5–4.5 mm long, continuous with pedicel although rarely appearing articulate as fruit matures, the tube campanulate and ± flaring distally, ca. 1–1.5 mm high and 2 mm in diam., glabrous to densely hirsutulous with white, downwardly reflexed, delicate, white trichomes, the limb flaring above, glabrous to pilosulose, the lobes deltoid, acute to obtuse, ca. 1–2 mm long, ciliate or puberulous to pilosulose; corolla with aestivation open, membranaceous, unistratose, campanulate, ca. 4.7–6(–8) mm long, white, glabrous, deeply-lobed, the lobes deltoid to oblong, acute to rounded, ca. 3–4 mm long; stamens 10, conspicuously exserted (rarely included), ca. (4.8–)8.5 mm long, the filaments ca. (2.7–)3 mm long, flattened, densely hirsutulous externally and glabrous internally, the anthers ca. (3–)5–6.5 mm long, bearing dorsally, ascending or horizontally widespreading, slender, finely muricate spurs ca. 0.7–2 mm long, the thecae ca. (1.3–)2–2.5 mm long, sharply and finely muricate, the tubules ca. (1.7–)3–4.5 mm long, muricate, dehiscing by short, introrse, slightly oblique pores that are marginally irregularly 2–4-dentate (lacinate); styles long-exserted, to 11 mm long. *Berry* spherical, 5–10 mm in diam., black, sparingly to moderately pilosulose, 5-locular (?).

Distribution.—Montane forests, dry pine forests, and oak-pine forests of the Sierra Madre Oriental of Mexico from Nuevo León and Tamaulipas, south through San Luis Potosi, Puebla, Hidalgo, and Vera Cruz, at 1550–1785 m. Flowering: Apr–Jul; fruiting: Jun–Sep.

Vaccinium kunthianum is characterized by a calyx that is continuous with the pedicel, a corolla that is open prior to anthesis and enlarges thereafter, by anthers conspicuously exserted beyond the corolla tube, and by anther spurs present.

This is the only Mexican representative of the very distinctive subgenus *Polycodium* (Raf.) [= sect. *Polycodium* (Raf.) Rehder], a largely eastern North American taxon often treated as the separate genus *Polycodium* Raf. It is all too easy for us to discount Rafinesquian genera out-of-hand, but this segregate genus does have the independent approbation of Nuttall (1843), one of our historically most critical and acclaimed botanists, who segregated this group of species from *Vaccinium* as the genus *Picrococcus* Nutt. The systematics of *Polycodium* whether treated as a section, subgenus, or genus is unresolved. As many as 20 species or as few as one species (Baker 1970) have been recognized. Recently, Vander Kloet (1988) recognized a single species in eastern North America, *V. staminium* L., while relegating the Mexican outliers in the Sierra Madre Occidentale to synonymy. Too little material is available to be dogmatic, but the Mexican plants seem very unlike the common *V. stamineum* of eastern North America. Therefore, for the present the *Vaccinium kunthianum* is best treated as a distinct species. Like almost all species in Mexico and Central America much more intensive field observation and collecting is needed.

Additional collections examined: **MEXICO. Nuevo León:** oak-pine forest 8 mi E of Dulces Nombres, 1550 m, 30 Jun 1948, *Meyer & Rogers 2708* (MO); abundant in open pine forest and oak scrub, La Trinidad, Municipio de Mantemorelos, 19 Aug 1939, *Muller 2843* (GH, LL, NY). **Taumaulipas:** Sierra de Guatemala, 23°5-7'N, 99°15'W, just W of Tierra Colorado, 19–25 Aug 1984, *Johnston 12813* (TEX). **San Luis Potosi:** Cerro El Agujón, cerca de El Zapote, approx. 30 km al SSW de Río Verde, 1750 m, 13 May 1968, *Rzedowski 25675*

(CAS, LL, MICH, MSC, RSA, WIS). **Puebla:** dry pine forests near Honey Station, 5800 ft, May 1904, *Pringle 8899* (CAS, CU, F, GH, K, MO, MIN, MSC, NY, PH, US). **Hidalgo:** on road to Encarnación from km. 240 on Pan-American Hwy., 2 Jun 1948, *Atchinson 512* (CU); Zimapán, *Coulter 892* (CGE, GH, K, NY, PH); District Zacualtipján pine woods and sphagnum bogs ca. 3 mi from Zacualtipán on road to Tianguistengo, 2100 m, 4 Jul 1947, *Moore 3305* (CU, GH). **Veracruz:** Municipio de Zacualpán, 2500–2600 m, 20°24'W, 98°26'W, 9 mi SE of Palo Bendito, bosque de piños, 22 Jul 1982, *Nee & Diggs 25228* (F).

2. Vaccinium geminiflorum Kunth in H.B.K., Nov. Gen. Sp. Pl. 3:267, t. 252. 1818. TYPE: "Crescit in Regno Mexicano, inter Omitlan et Moran, alt. 1400 hex," (HOLOTYPE: P-HBK!; ISOTYPES: B†, B-Willd. 8315-1!). The isotype in the Willdenow Herbarium has on its label "*leg. Humboldt & Bonpland s.n.*" and "*Vaccinium geminiflorum* H.B.K." written by Klotzsch (P. Hiepko 2007 to JLL).

Erect, rhizomatous, densely branched *shrublets* mostly 10–25 cm tall, often forming dense colonies, glabrous throughout with the exception of the youngest stems and leaves; branchlets angled, at first densely but minutely puberulent but becoming glabrate. *Leaf-blades* deciduous or briefly persistent, membranous, oblanceolate or narrowly oblong-obovate to somewhat elliptic, 5–20(–32) mm long, 3–8(–12) mm wide, apically obtuse to acute, basally narrowed to a ± cuneate base, marginally finely crenate-serrulate with the teeth usually terminated especially when young with a very short, gland-tipped vein, both surfaces glabrous but the veins (especially when young) often very minutely and sparsely puberulous, the venation pinnate, forming a conspicuous, elevated reticulum on both surfaces at least when dried; petioles 1–2 mm long, semicircular in cross-section, flatly grooved above, glabrous. *Inflorescences* axillary, of solitary flowers; floral bracts leaf-like in shape and texture, 4.5–6 mm long; pedicels recurved, 3–5 mm long, slightly and very shortly puberulous to glabrous; bracteoles basal, caducous, oblong, rounded, ca. 4–5 mm long, covering pedicel and calyx. *Flowers* 5-merous; calyx 2–3 mm long, continuous with pedicel, the tube campanulate, ca. 1.4–1.8 mm long, glabrous, the limb distally truncate to minutely lobed, the lobes obscure to broadly ovate, apically rounded to apiculate, ca. 0.3–1 mm long, glabrous, occasionally with minute, glandular (glaucous?) scales; corolla with aestivation imbricate, membranous, unistratose, cylindrical to more typically squatly barrel-shaped or globose-urceolate, 4–6 mm long, 3–4 mm broad, white to pinkish or even roseate, glabrous, the lobes broadly rounded, 0.8–1.5 mm long; stamens 10, included, ca. 3.5–4.5 mm long, the filaments ca. (l–)2–2.4 mm long, glabrous, the anthers ca. 2.5 mm long, dorsally bearing 2, slender, antrorsely and minutely barbellate, strongly ascendent spurs ca. 0.6–2.2 mm long, the thecae ca. (0.5–)1–1.4 mm long, papillose, the tubules ca. 0.9–1.7 mm long, 10 or more times as long as wide, dehiscing by oblique or nearly terminal introrse pores. *Berry* dull blackish, unknown at maturity.

Distribution.—Montane pine-oak forests, alpine meadows, boulder fields, and seepage areas, from Chihuahua and Nuevo Leon south throughout much of mountainous Mexico into Guatemala, at 1785–4110 m. Flowering: throughout most of the year but mostly from Feb–Aug; fruiting: Mar–Oct.

Vaccinium geminiflorum is characterized by its subshrub, rhizomatous habit, deciduous (or nearly so) leaves, calyx that is continuous with the pedicel, corolla with imbricate aestivation, long-spurred anthers, and comparatively large and long bracteoles.

The most extensive discussion of the Mexican and Guatemalan members of the *V. cespitosum - geminiflorum* complex was that of Camp (1942), based largely on his observations in western Mexico. Vander Kloet (1988) recognized both *V. cespitosum* Michx. and *V. geminiflorum* Kunth as occurring in Mexico with *V. cespitosum* represented by "one disjunct population" although his map shows three widely separated localities in western Mexico. Camp noted that the plants of *V. geminiflorum* from lower elevations, seldom if ever subjected to frost, had persistent leaves while those from higher elevations had deciduous leaves. Roughly correlated with persistence and lower elevations were more deeply grooved twigs and narrow, relatively longer leaves at the lower elevations, while at higher elevations the twigs are more likely to be subterete and the leaves wider. Camp concluded that because of the morphological intergradation that it would be best to maintain the Mexican material of this complex or section under a single name, *V. geminiflorum*. He speculated that in the Pleistocene the widespread northern *V. cespitosum* had had to migrate into Mexico where it encountered *V. geminiflorum* and hybridized with it resulting in the great variability in the populations encountered in the mountains of central Oaxaca. We are unable to evaluate this suggestion.

The focus of vander Kloet's earlier publications was upon the North American representatives of the

genus, but he also delt with the species of "northern Mexico." Only Mexican species whose range was largely in the United States and Canada were included in his account: *Vaccinium cespitosum* Michx. and *V. kunthianum* Kunth (as *V. stamineum* L.). Little material was available to him for study. From vander Kloet's keys and descriptions the following key has been extracted.

Leaf margins sharply serrate along most its length; blade often sparsely glandular beneath; berry dull black; restricted to Mexico and Guatemala _____ **V. geminiflorum**

Leaf margins usually serrulate from the apex to at least the middle of the blade; blade often somewhat glandular beneath; berry usually blue and glaucous, or rarely dull black; ranging from Labrador to Alaska and south into New England, Wisconsin, Colorado and California with three disjunct localities in Mexico _____ **V. caespitosa**

Additional collections examined: **MEXICO. Chihuahua:** Municipio de Bocoyna: E of Creel, on W facing slope in pine-oak forest, ca. 7100 ft, 8 May 1973, *Bye 3690* (TEX); high mountains above Barranca de Cobre, 6–7000 ft, Jun 1892, *Hartman 527* (GH). **Nuevo León:** alpine meadow, 12,500 ft, summit of Cerro Potosí, 24°53'30"N, 100°10'30 W, 19 Jun 1966, *Gilbert 30* (TEX). **Zacatecas:** Sierra de los Huicholes on road NE from San Juan Peyotán, Nayarit, towards Aserradero Tepetates, 5–25 km N of Nayarit-Zacatecas boundary, 2400–2600 m, 13 Jan 1975, *McVaugh 25770* (MICH). **Durango:** high plateau with *Pinus, Quercus, Artostaphylos* and *Garrya*, 55–60 km SW of Durango City on road to La Flor, 2400 m, 16 Sep 1979, *Breedlove 44097* (CAS); 8–10 km al S de El Salto, hacia Pueblo Nuevo, Municipio de El Salto, 2000 m, 3 Jul 1982, *Hernández & Tenorio 7589* (MO, NY); Laguna del Progreso, 34 road mi N of railroad at Coyotes, lumber camp in dense oak-pine forest on S facing slopes of barranca, 2500–2600 m, 21 Jul 1955, *Maysilles 7887* (MICH). **Hidalgo:** 1.5 km al NNW del Nopalillo, Municipio de Epazoyucan, 2850 m, 14 May 1976, *Medina 1964* (MICH); Peñas Largas, cerca de Tezoantla, Municipio de Real del Monte, bosque de *Abies*, 2750 m, 21 Apr 1966, *Rzedowski 22184* (MSC). **Veracruz:** steep slopes among turf and scattered shrubs and thin pine woods, Mt. Orizaba, 10,400 ft, 28 Apr 1938, *Balls 4384* (A, AAU, K, NY, US); in pine woods, Cofre de Perote, 10300 ft, 2 May 1938, *Balls 4564* (A, K, NY, US). **Puebla:** Ixtaccihuatl, S side of mountain, boulder crevices in alpine meadow, 3960 m, 1 Aug 1958, *Beaman 1995* (GH, MSC); dry pine forests, Honey Station, 5800 ft, Apr 1904, *Pringle 8960* (A, AAU, CAS, CU, F, GH, K, MIN, MO, MSC, NY, PH, US). **Distr. Federal:** in alpine meadow, top of Cerro Ajusco, 3937 m, 12 Jul 1959, *Beaman 2781* (MSC). **Mexico:** grassy ravine in alpine meadow N side of Nevado de Toluca; 0.7 mi E of point where road goes above timberline, 3985 m, 28 Jul 1958, *Beaman 1926* (GH, MSC, TEX, US, WIS); Municipio de Amecameca, slopes of Popocatepetl, ca. 11,000 ft, 4 Jul 1943, *Gily & Dodds 9* (MICH, MSC, NY); Distr. de Temascaltepec, Crucero, grassy hill, 2880 m, 1 Jul 1933, *Hinton 4190* (F, K, MO, NY); rocky moist tussock grassland on very steep slopes, alpine zone on SW slope of Volcán Iztaccihuatl, 5–6 km N of Paso de Cortés, 16 Aug 1960, *Iltis, et al. 1039* (MSC, WIS); Sierra del Monte Alto, Paraje El Guardita, cerca del Cerro La Malinche, 3200 m, 13 Apr 1966, *Rzedowski 22130* (DS, MICH, MSC). **Jalisco:** Nevado de Colima, 12500 ft, 16 May 1893, *Pringle 4375* (F, GH, K, MIN, MO, MSC, MU, NY, PH, US). **Guerrero:** pine forest, Teotepec, Distr. de Miña, 3200 m, 17 Jul 1939, *Hinton et al. 14450* (F, GH, LL, MO, NY, PH, US). **Oaxaca:** top of the mountain just below the stone of sacrifice, Zempoaltepetl, 19–27 Feb 1937, *Camp 2651* (AAU, CAS, DUKE, MICH, MO, NY, US); crest of Mexican Hwy. 175, 30.5 mi N of Guelatao, open, moist, rounded top of mt. ridge, ca. 10,000 ft, 24 Dec 1975, *Reznicek & Gregory 328* (MICH). **Chiapas:** slopes with *Pinus, Quercus* and *Arbutus*, 5 km N of Mexican Hwy. 190 on logging road from Laguna Chamula microwave station, 2400 m, 15 Oct 1976, *Breedlove 40755* (DS). **GUATEMALA. Chimaltenango:** in meadow above timberline, NW side of Volcán Acatenango, ca. 3760 m, 16 Aug 1959, *Beaman 3270* (GH, MSC). **Huehuetenango:** Sierra de los Cuchumatanes, summit between Tojquia and Caxin bluff, 3700 m, 6 Aug 1942, *Steyermark 50214* (A, F, NY, US). **Quezaltenango:** summit of Volcán Santa María, 12,400 ft, 26 Jul 1934, Skutch 837 (A). **Sacatepequez:** summit of S rim of crater, 3760 m, 31 Jul 1959, *Beaman 2925* (GH, MSC, TEX, US). **San Marcos:** in gravelly soil above timberline, E side of peak, Volcán Tajumulco, ca. 4110 m, 9 Aug 1959, *Beaman 3159* (GH, MSC, TEX, US).

3. Vaccinium dissimile S.F. Blake, J. Bot. 53:271. 1915. *Disterigma dissimile* (S.F. Blake) S.F. Blake, Proc. Biol. Soc. Washington 35:120. 1922. *Sphyrospermum dissimile* (S.F. Blake) Luteyn, Opera Bot. 92:126. 1987. TYPE: COSTA RICA. SAN JOSÉ: La Palma, 1500 m, Aug 1898, *Tonduz 12546* distributed as *J. Donnell Smith 7380* (LECTOTYPE: K! ISOLECTOTYPES: BM! F! GH! K! MO! NY! US!).

Creeping, epiphytic or terrestrial, viney *shrublets* with stems interwoven amongst bryophytes; branchlets wiry, perhaps to 1 m long, 1–1.5 mm in diam., the young stems densely spreading puberulent, glabrous in age. *Leaf-blades* persistent, coriaceous, evergreen, ovate, lance-ovate, or narrowly to broadly elliptic, mostly 1–3(–4) cm long, 8–15(–20) mm broad, apically acute, basally rounded to cuneate, marginally entire, glabrous or beneath sparingly to moderately beset with dark, glandular, appressed trichomes 0.1–0.2 mm long, the venation obscure; petioles 1–2 mm long, puberulent. *Inflorescences* axillary, of solitary flowers; floral bracts broadly reniform, ca. 0.3–0.4 mm long, rounded, glabrous; pedicels 1–2(–4 or –8?) mm long; bracteoles basal, ovate to broadly oblong, opposite, obtuse to broadly rounded, 0.8–1 mm long and nearly as wide, puberulent. *Flowers* 4-merous; calyx ca. 2.2–2.8 mm long, continuous with pedicel, the tube campanulate, 0.8–1.2 mm long, densely hirsutulous with hyaline trichomes 0.1–0.2 mm long, the lobes broadly deltoid, acute, 0.7–0.8 mm long, moderately to densely hirsutulous; corolla with aestivation valvate, thinly fleshy, bistratose, campanulate to broadly flaringly funnelform, 7–10 mm long, 6–9 mm in diam. at the apex or the

broadest point, red, sparingly and inconspicuously beset with spreading, gland-tipped trichomes 0.1–0.2 mm long, the lobes erect, acutely deltoid, 1.5–2 mm long; stamens 8, included, ca. 4.3–5.8 mm long, the filaments 1.3–4 mm long, elliptical, tapering both to the base and the apex where ca. 0.5 mm wide, sparsely pilose, the anthers medifixed, 2–3.3 mm long, lacking spurs, the thecae ca. 1.7 mm long, conspicuously papillose, the tubules 1.6–2.5 mm long, dehiscing by introrse clefts 0.5–0.7 mm long. *Berry* bluntly 4-angled, oblate, 0.7–1 cm in diam., translucent white, densely hirsutulous, 4-locular.

Distribution.—Wet mountain slopes dominated by premontane rainforests and elfin thickets of shrubs and small trees in Costa Rica and Panama and also in NW South America (Colombia and Ecuador), at 500–1800 m. Flowering and fruiting: throughout much of the year but perhaps heaviest from Feb–Aug.

Vaccinium dissimile is characterized by its lianoid, thin-stemmed habit, short pedicels, and dark red, campanulate corollas. This is another species of *Vaccinium* that rests not too comfortably with its supposed congeners. S.F. Blake, who orginally named the species as a *Vaccinium*, later transfered it into the genus *Disterigma*. Luteyn, currently the leading authority on the neotropical representatives of the family, has concluded that this species should be placed in the genus *Sphyrospermum* Poeppig & Endlicher as shown by the mature fruit: "The fruits of *Vaccinium* and *Disterigma* (and most ericaceous blueberries) have a thick and leathery pericarp that dries that way, and the seeds have normal embryos whereas in *Sphyrospermum* and *Themistoclesia* the pericarp is very thin and papery ... and the seeds have a green embryo ..." (Luteyn 1987, p. 126). [Note: RLW, first author of this paper, wishes to treat this species in *Vaccinium*; JLL, second author of this paper, however, disagrees and still maintains the species belongs in *Sphyrospermum*.]

Additional collections examined: **COSTA RICA. Heredia:** forest along new road to the N of Quebrada Tigre from Finca El Plastico to ca. 1.5 km NE thereof, ca. 8 km SW of Las Horquetas, 10°18'N, 84°02'W, 450–550 m, 14 Feb 1986, *Grayum & Sleeper 6510* (DUKE, MO). **San José:** forested thickets and weedy roadside at Alto La Palma ca. 8 mi NNE of San Vincente de Moravia on the eastern flank of Volcán Barba, ca. 1500 m, 23 May 1972, *Wilbur & Almeda 16898* (CAS, CR, DUKE, F, GH, LL, MICH, MO, NY, US, PMA, WIS). **PANAMA. Bocas del Toro:** Cerro Colorado, road along top, 1500–1750 m, 13 Aug 1977, *Folsom et al. 4726* (DUKE); forested slopes, Fortuna Dam region, along trails leaving pipeline road, ca. 8°45'N, 82°15'W, ca. 1000 m, 8 Dec 1985, *McPherson 786* (DUKE, MO). **Chiriquí:** cloud forest, Cerro Colorado, ca. 50 km N of San Félix, ca. 1400 m, 17 Aug 1975, *Dressler 5086* (DUKE, MO). **Veraguas:** 11 km from Escuela Agrícola Alto de Piedra, in forest along Río Dos Bocas, Atlantic slope, 15 Nov 1974, *Mori & Kallunki 3147* (MO). **Coclé:** Cerro Pajita, hills N of El Valle, 1100 m, 27 Oct 1946, *Allen 3782* (MO, US); Atlantic slope near sawmill above El Cope, 8°40'N, 80°36'W, 750–800 m, 13 Feb 1982, *Knapp & Dressler 3494B* (DUKE, MO); La Mesa, 5 mi N of El Vallé, 2500 ft, 10 Nov 1965, *Tyson & Godfrey 2443* (DUKE, MO). **Panamá:** Cerro Jefé, new road leading N from summit, 26 Sep 1975, *Witherspoon 8526* (DUKE, MO). **Colón:** S approach of Cerro Bruja from Río Escandaloso, 18 May 1978, *Hammel 3123* (MO). **San Blas:** premontane rain forest, Cerro Brewster, 9°18'N, 79°16'W, 800–850 m, 20 Nov 1985, *de Nevers et al. 6269* (DUKE, MO). **Darién:** Sambú Basin, Cerro de Garagara, 500–974 m, 7 Feb 1912, *Pittier 5644* (US).

4. Vaccinium leucanthum Schltdl., Linnaea 8:524. 1833. TYPE: MEXICO. VERACRUZ: "infra S. Salvdor...Pr. Chiconquiaco" [in mountains up to 6000 ft between Misantla and Jalapa], *Schiede 174* (HOLOTYPE: B†; LECTOTYPE, designated here: NY! ISOLECTOTYPES: K! MO! P! W!). [The label of the NY sheet (ex Meisner herb.) reads "Infra S. Salvador, Mexico"; the K sheet reads "pr. Chiconquiaco" and is without a collection number; the MO sheet reads simply "Mexico."]

Vaccinium schlechtendalii G. Don, Gen Syst. 3:856. Nov 1834. TYPE: MEXICO: "near Jalacinga, in woods." The actual collection and location of Don's type specimen is unknown. *Metagonia schlechtendalii* (G. Don) Nutt., Trans. Amer. Phil. Soc. n.s. 8:266. 1843.

Vaccinium micranthum Dunal, Prodr. 7:568. 1839. TYPE: MEXICO: "inter Tampico et Real del Monte," *Berlandier 329 (pl. exs. n. 12)* [HOLOTYPE: G-DC (photos F neg. 33846 and NY neg. s.n.); ISOTYPES: BM!, NY frag. ex G-DC!, OXF! P!]. The type specimen in the DeCandolle Herbarium (G), as seen in person (JLL) has a label that gives the number "*12 ex.*" in the upper left corner and the number "329" in the upper right corner. There is a fragment of the G-DC type at NY, three specimens of *Berlandier 329* at P!, and one each at the BM and OXF (all isotypes). The actual collection number is *Berlandier 329* and the collection is number 12 in an exsiccatae sent out by Berlandier. It is also possible that the plants named by George Don (1834) and by Dunal (1839) are the same collection.

Terrestrial *shrubs* 1–4.5 m to *trees* to 15 m tall; branchlets somewhat angulate when young but becoming terete, minutely but densely puberulent or glabrate. *Leaf-blades* persistent, coriaceous, evergreen, lanceolate to lance-oblong to ovate, highly variable in shape and size, mostly 2–5(–7.5) cm long, 1.2–2.6 cm broad, apically usually acute to less commonly obtuse or rounded, not mucronate, basally cuneate to rounded, marginally crenate-serrate, when mature glabrous or at most very sparingly puberulous (or even densely but often inconspicuously so along the midrib above), when young glabrous to densely puberulous beneath with midrib puberulous above, rarely glandular-punctate beneath, the venation pinnate; petioles 2–4 mm long,

semicircular in cross-section, broadly and shallowly grooved above, glabrous to densely short-puberulous. *Inflorescences* axillary, sometimes arising from leafless nodes, racemose, 5–16-flowered; rachises finely ridged and grooved, (1.5–)5–9 cm long, 0.5–1 mm in diam., densely to sparsely but minutely puberulent; floral bracts caducous, oblong, cuculate, ca. 1.5–4 mm long, 2–2.5 mm broad; pedicels nodding, often somewhat secund, ca. 1.5–7(–12) mm long, finely but densely to sparsely puberulent; bracteoles located medially to just above or below middle, ± opposite, caducous, linear, 1.5–2.5 mm long, glabrous to puberulous, caducous. *Flowers* (4–)5-merous; calyx 2.5–2.7 mm long, conspicuously articulate with pedicel, the tube obconical, 1–1.5 mm long, sparingly to very densely puberulent, the lobes deltoid, acute, 0.8–1.5 mm long; corolla with aestivation imbricate, membranous, unistratose, broadly campanulate to urceolate, 3–6 mm long, white to pinkish tinged, glabrous externally, the lobes deltoid, acute, 1–2.2 mm long; stamens (8–)10, included, 2.8–5.4 mm long, the filaments ca. 1–3.2 mm long, ciliate distally, the anthers 1.7–3.4 mm long, typically bearing dorsally 2, slender, strongly ascendent and outwardly divergent spurs ca. 0.6–1.2 mm long but these apparently sometimes represented by vestigial remnants 0.1–0.5 mm long, the thecae ca. 1–1.5 mm long, the tubules ca. 0.7–2 mm long, dehiscing by short, oblique, introrse, oval pores; nectariferous disk glabrous. *Berry* spherical, ca. 5–8 mm in diam., blackish, puberulous to glabrate, falsely 10-locular.

Distribution.—Montane pine-oak and both evergreen and deciduous forests, thickets and clearings from Hidalgo south through Vera Cruz into Michoacán, Oaxaca, and Chiapas (Mexico), and much of mountainous Guatemala to Honduras, mostly between 1500–3000 m. Flowering: throughout the year but peaking from Apr–Jul; fruiting: throughout the year.

Vaccinium leucanthum is characterized by its broad, crenate-serrate leaves, long-racemose inflorescences, its calyx articulate with the pedicel, spurred to unspurred anthers, and a falsely 10-locular berry. No other species of *Vaccinium* in either Mexico or Central America has proven as baffling as *V. leucanthum*. As interpreted in this treatment, it has the greatest range of floral morphological variability of any species in the area. On numerous occasions it was felt that a set of characters had been detected that would allow the clean separation of a block of disconcerting variability but analysis of more specimens dashed the supposed solution. The most strikingly variable features are in leaf size and shape, number of perianth parts, and length of the anther spurs. The variablility of spur length proved especially vexing for *a priori* it was felt that spur length was of "fundamental" importance. These spurs ranged from slender, upwardly arching, long, horn-like appendages to the merest protuberance and in some cases could not be detected with certainty and so might well be absent. The presence or absence of spurs has usually been treated as of sectional, subgeneric or even generic significance within the Vaccinieae. Belatedly and no doubt reluctantly, it was impossible to employ anther spurs as a taxonomically useful character in this species. This is not a wholly satisfactory solution; it just happens to be the best that can be done now. Extensive field work throughout the range of *V. leucanthum* would probably be most helpful in resolving the apparent uncertainties. It would also appear that the problems associated with this species can only be resolved in conjunction with its relatives in the Andes of South America and the West Indies.

Additional collections examined: **MEXICO. Hidalgo:** Dist. Tulancingo, dry ravine and ridges in pine-oak woods near Rancho San Alajo between Tulancingo and Acaxochitlán, 7000 ft, 13 May 1947, *Moore 2820* (CU, GH, MICH); hills ca. Trinidad Iron Works, 5800 ft, 6 May 1904, *Pringle 8883* (A, CAS, CU, F, GH, LL, MIN, MO, MSC, PH, US). **Veracruz:** Perote, La Joya, 6500 ft, on old lava in crevices and partial shade of open woods of *Pinus*, 23 Sep 1938, *Balls 5519* (GH, US); Ocotepec, cerca del Cerro, Municipio de Jalacingo, 1800 m, bosque de encino, ladera de cerro, 4 Mar 1970, *Ventura A. 1006* (DS, F, MICH, MO, NY). **Puebla:** mountain forest W of Huauchinango, 1 Nov 1943, *Lundell 12640* (GH, MICH, MO, NY, US); in *Pinus-Quercus-Podocarpus* forest, near hwy. between Beristáin and Huauchinango, *Ogden & Gilly 51212* (DUKE, MICH). **Michoacán:** bosque de pino, San Miquel del Monte, 15 km al SE de Morelia, 2200 m, 17 Sep 1967, *Rzedowski 25165* (CAS, LL, MICH, MSC). **Oaxaca:** very wet forest of pines, oaks and other trees, along road from Teotitlán del Camino to Huautla de Jiménez, 2250–2300 m, 12 Jul 1968, *Anderson 4739* (DUKE, MICH, NY); top of Zempoaltepetl, 19–27 Feb 1937, *Camp 2660* (AAU, CAS, DUKE, F, GH, MO, US); Villa-Alta, Yalina, El Rincon, 4–6500 ft, *Galeotti 1809* [NY; not a type of *V. caracasanum* Kunth (1818), the name was only misapplied by Martens and Galeotti (1842)]. **Chiapas:** slope with *Quercus* on boundary between Zinacantán and Chamula along road to Zinacantán Center, 7800 ft, 20 Jan 1965, *Breedlove & Raven 8135* (DS, F, LL, MICH, MSC, WIS); steep wooded slopes on the bank of the Río Hondo 4 mi N of Jitotol on road to Pueblo Nuevo Solistahuacán, Municipio de Jitotal, 5500 ft, 31 May 1965, *Breedlove 10178* (DS, F, LL, MICH); evergreen cloud forest on the N and W slope of the Cerro Mozotal below the microwave tower along

the road from Huixtla to El Porvenir and Siltepec, Municipio de Motozintla, 3000 m, 28 Jun 1972, *Breedlove 25827* (DS, DUKE, MICH, MO, NY, RSA); steep slopes with montane rain forest-evergreen cloud forest and elfin forest on the SE side of Cerro Tres Picos and the ridges near summit, 2100–2500 m, 11 Dec 1972, *Breedlove & Thorne 30138* (DS, DUKE, F, MICH, MO, NY, RSA, TEX); Sierra Madre de Chiapas, *Pinus-Liquidambar* forest, between Finca Liquidambar and Neuva Colombia, 2500 m, 18 Jun 1985, *Luteyn & Lebrón-Luteyn 11574* (MEXU, MO, NY). **GUATEMALA. Bajo Verapaz:** open areas above Santa Catarina, 5000 ft, 24 Feb 1945, *Sharp 45254* (GH). **Chiquimula:** mixed forest below cloud forest, middle slopes of Montaña Norte to El Jutal on Cerro Brujo, SE of Concepción de las Miñas, 1700–2000 m, 2 Nov 1939, *Steyermark 31056* (F). **Huehuetenango:** dry roadside bank, 8100 ft, road #9 ca. 13.3 mi S of Santa Eulalia, Sierra de los Cuchumantanes, 31 Dec 1972, *Almeda & Luteyn 1689* (DUKE, F, MICH); bushy mountain side, Soloma, 7400 ft, 21 Aug 1934, *Skutch 1059* (A, F, NY, US). **Progreso:** on summit of Volcán Siglo, 3300 m, 21 Jan 1942, *Steyermark 43080* (A, F). **El Quiché:** in arroyo, Nebaj, 5 Jun 1964, *Contreras 4883* (CAS, GH, LL); trail between Nebaj and Chajul, 6 Feb 1946, *Sharp 4666* (GH, MO, NY). **Zacapa:** trail between Santa Rosalia de Marmol and Vegas, 19 Jan 1942, *Steyermark 42912* (F). **HONDURAS. Comayagua:** "Camp Don Thomas," 10 km SW of Gracias, 1850–2050 m, 10 May 1992, *D'Arcy 17889* (MO); **Cortes:** Cusuco National Park, trail from Cerro Cantiles to Cerro Jilinco, 2240 m, 20 Mar 1993, *Hawkins 659* (MO); **Lempira:** montaña de Celaque, 2650 m, 18–22 Nov 1974 (MO); Parque Nacional Celaque, cloud forest on ridge to Cerro Oeste del Río Naranjo, 2300 m, 9 Jul 1991, *House 1036* (MO).

5. **Vaccinium stenophyllum** Steud., Nomencl. Bot. 2:740. 1841.

Vaccinium angustifolium Benth., Pl. Hartweg, 45. 1840, non Aiton (1789). TYPE: MEXICO. JALISCO: "in regione frigida prope Bolaños," *Hartweg 342* (HOLOTYPE: K-Herb. Benth.! photos Univ. Michigan neg. 694 and NY neg. s.n., frag. NY; ISOTYPES: BM! CGE! K-Herb. Hook.! NY! OXF! P!).

Vaccinium angustifolium Benth. var. ß *glaucescens* Benth., Pl. Hartweg, 45. 1840. *Vaccinium glaucescens* (Benth.) Riley, Kew Bull.185. 1922. TYPE: MEXICO. JALISCO: "in regione frigida, prope Bolaños," *Hartweg 342B* (HOLOTYPE: K-Herb. Benth.! photo NY neg. s.n., frag. NY!).

Vaccinium gonzalezii Riley, Kew Bull. 116. 1923. TYPE: MEXICO. SÍNALOA: San Ignacio, Mesa de Bueso, 1250 m, *Gonzalez 839* (HOLOTYPE: K! frag. NY!; ISOTYPE: K!).

Terrestrial *shrubs* or small *trees* 1–4(–6) m tall; branchlets slender, glabrous to densely, shortly puberulous, sometimes glaucous. *Leaf-blades* persistent, coriaceous, evergreen, narrowly lanceolate, lance-elliptic to linear-oblong, 1–4(–6.5) cm long, (4–)8–12(–15) mm broad, apically acute to acuminate, shortly and deciduously mucronate, basally cuneate, marginally entire to minutely serrulate with the teeth often glandular-tipped, lustrous above, glabrous or very nearly so on both surfaces except often densely puberulous along the midrib above, the venation pinnate, conspicuously reticulate and often raised on both surfaces; petioles 1–2(–3) mm long, subterete to broadly and shallowly canaliculate above, glabrous to densely although minutely puberulent. *Inflorescences* axillary, either leafy racemes of 3–10 flowers each, **or** flowers solitary in axils of apparently normal or reduced leaves at tips of branchlets and then inflorescences apparently differing little from leafy, vegetative branchlets; rachises (when present) finely ridged and grooved, mostly (1.5–)3–6 cm long, ca. 1 mm in diam., puberulent to glabrous, sometimes glaucous; floral bracts slightly smaller than the foliage leaves and of similar shape and texture, 8–30 mm long, 2.5–9 mm broad, puberulent to glabrate; pedicels nodding or at least strongly divergent, mostly (2–)4–8(–10) mm long, 0.2–0.3 mm in diam., glabrous or sometimes puberulent, sometimes glaucous; bracteoles nearly basal, caducous, subopposite to clearly alternate, oblong to lance-elliptic or linear, 1.2–2.2 mm long. *Flowers* 5-merous; calyx 3.5–4.6 mm long, conspicuously articulate with pedicel, puberulent to glabrous, sometimes glaucous, the tube obconic to somewhat campanulate, 1.5–2 mm long, the lobes deltoid, acute to acuminate, ca. 1.2–2 mm long, glabrous to densely ciliolate at tips; corolla with aestivation imbricate, membranous, unistratose, cylindric to urceolate, 5–7 mm long, whitish to creamy, glabrous externally, the lobes deltoid, acute, 1.2–2.2 mm long; stamens 10, included, 3.5–4.3 mm long, the filaments ca. 1–1.6 mm long, weakly to densely ciliate, the anthers ca. 2.8–3.5 mm long, dorsally bearing slender, strongly ascendent spurs 0.6–1.4 mm long, the thecae ca. 1–1.7 mm long, the tubules slender, 1.2–1.8 mm long, dehiscing by short, introrse, oblique pores; styles included; nectariferous disk glabrous to shortly and densely white-pilose. *Berry* spherical, 5–9 mm in diam., blackish, puberulous or glabrous, sometimes glaucous, falsely 10-locular.

Distribution.—Mountain slopes of the Mexican Sierra Occidentale from Durango south into Oaxaca (Durango, Sínaloa, Nayarit, Jalisco, and Oaxaca), dominated by open pine-oak forests and rocky slopes and summits, mostly between 1075–2800 m. Flowering: (Jan–)Mar–Aug(–Oct); fruiting: (Jan–)Jun–Oct(–Dec).

Vaccinium stenophyllum is characterized by narrowly lanceolate, lance-elliptic to linear-oblong leaves with prominent venation and mucronate tips, inflorescences of leafy racemes **or** flowers solitary in the axils of apparently normal or reduced leaves, a calyx that is articulate with the pedicel, spurred anthers, an often shortly and densely pilose nectariferous disk, and falsely 10-locular berry. Louis Williams (1965, and in Standley & Williams 1966) included *V. stenophyllum* in the *Flora of Guatemala* even though he stated that "the material from Guatemala is hardly, if at all, distinguished from *V. leucanthum*." For this study, no specimens of *V. stenophyllum* have been seen south of Jalisco, while *V. leucanthum* is well-represented in Guatemala. Plants of *V. stenophyllum* are not at all reminiscent of *V. leucanthum*. We agree with Sleumer (1936) that *V. gonzalezii* is merely a broader leaf form of *V. stenophyllum*.

Additional collections examined. **MEXICO. Durango:** bosque 19 km de Los Charcos, por el camino a Sta. María Ocotán, Municipio de Mezquital, 2400 m, 4 Oct 1983, *Gonzalez 2582* (NY). **Sínaloa:** Mesa de Bueso, San Ignacio, 1250 m, 15 May 1919, *Montes & Salàzar 839* (US). **Nayarit:** steep slopes with *Pinus* and *Quercus* along unused road from Mesa del Nayar to Santa Teresa, Municipio de Nayar, 1850 m, 12 Aug 1980, *Breedlove & Almeda 45509* (CAS, MO, NY). **Jalisco:** slope with *Pinus, Quercus* and Arbutus 15 km NW of Los Volcanes on road to Talpa de Allende, Municipio de Aytenguillo, 1890 m, 27 Nov 1983, *Breedlove & Almeda 60617* (CAS, MO, NY); Sierra de Manantlán, 25–30 km SE of Autlán, along lumber roads E of the road crossing called "La Cumbre," between El Chante and Cuzalapa, 19°35'N, 104°8-15'W, summits of high S-facing cliffs, 2750 m, 20–21 Mar 1965, *McVaugh 23131* (MICH); bare, gullied hillside, Hacienda del Cura, Sierra Madre, San Sebastián, 1425 m, 2 Jan 1927, *Mexia 1340* (A, CAS, DS, F, GH, MICH, MO, NY, US); Municipio de San Martín de Bolaños, Las Vidrieras, 10 km al NW de El Platanar, 2450 m, 1 Oct 1968, *Rzedowski 26156* (MICH).

6. Vaccinium consanguineum Klotzsch, Linnaea 24:64. 1861. TYPE: PANAMA: Volcán Chiriquí, *Warszewicz s.n.* (HOLOTYPE: B†, photo F neg. 4613).

Vaccinium irazuense Sleumer, Notizbl. Bot. Gart. Berlin-Dahlem 12:138. 1934. *Vaccinium consanguineum* Klotzsch var. *irazuense* (Sleumer) Sleumer, Notizbl. Bot. Gart. Berlin-Dahlem 13:126. 1936. TYPE: COSTA RICA. CARTAGO: Lava fielder Irazú, *Hoffman 140* (HOLOTYPE: B†, frag. US!).

Terrestrial *shrubs* or small *trees* (0.2–)1–3(–10) m tall, often compact and densely bushy; branchlets stiff, rigid, glabrous to densely puberulent. *Leaf-blades* persistent, coriaceous, evergreen, mostly narrowly to broadly elliptic, occasionally oblong, (1–)1.5–3(–4.6) cm long, 5–12(–18) mm broad, usually 2–3 times as long as wide, usually tapering to an acute apex and base, marginally callose-thickened and shallowly serrulate with teeth mostly (1–)2–4 mm apart, each tooth often tipped with a darkish glandular callosity, glabrous or with scattered glandular fimbriae beneath, moderately puberulous along the midrib, the venation pinnate; petioles 1.5–3 mm long, glabrous or puberulent. *Inflorescences* axillary, racemose, 5–10-flowered; rachises sharply angled, mostly 1–4 cm long, puberulent; floral bracts scarious, ovate to oblong, 2–5 mm long, slightly puberulent or ciliate; pedicels 1–2 mm long, puberulent; bracteoles subopposite, ovate to oblong, scarious, 1.5–3 mm long, ciliate but otherwise glabrous, entire to sparingly and also irregularly and minutely toothed. *Flowers* 4-merous; calyx 3–4 mm long, sharply articulate with pedicel, the tube campanulate, 1–2.3 mm long, glabrous, the lobes deltoid to broadly ovate, 0.8–1.5 mm long, apically ciliate but otherwise glabrous; corolla with aestivation imbricate, membranous, unistratose, cylindric, 5–7.5 mm long, 2.7–4.5 mm in diam., creamy white with tinges of red or pink, glabrous, the lobes oblong, 1–1.7 mm long; stamens 8, included, 4.4–5.7 mm long, the filaments 3–4 mm long, ciliate, the anthers 2.8–4 mm long, bearing dorsally 2, slender, horn-like, ascendent spurs 0.2–0.6(–1) mm long originating from near the apex of the thecae, the thecae 1.5–1.8 mm long, granular-papillate, the tubules 1.2–2 mm long, dehiscing by introrse clefts 0.5–0.7 mm long. *Berry* spherical, 5–6 mm in diam., reddish-to blackish-purple, 4-locular.

Distribution.—Mountain meadows, wooded montane slopes, oak forests, and paramillo thickets in Costa Rica and western Panama (Bocas del Toro and Chiriquí provinces), between (1300–)1500–3500(–3900) m. This species was included by Standley (1920–26, pp. 1101–1102) as a member of the woody flora of Mexico, but its presence north of Costa Rica was questioned by Sleumer (1936) and the species was not included by Standley and Williams in the *Flora of Guatemala* (1966). The species is known only from the mountains of Costa Rica and western Panama. Flowering: throughout the year with the preponderance between Jan–Jul; fruiting: throughout the year.

Vaccinium consanguineum is characterized by its pinnately nerved and serrulate-margined leaf blades,

racemose inflorescences with small white to pink flowers, spurred connectives (these rarely vestigial), and glaucous berries. The species varies from small, densely branched shrubs to large trees to 10 m tall. Leaf size also varies greatly with trees often having leaves at the higher end of the range. The small-leaved populations of *V. consanguineum* look especially like *V. floribundum*. Both species have spurred (or vestigially-spurred) anthers, although the Costa Rican populations of *V. floribundum* lack spurs. Nevertheless, *V. floribundum* would appear to be its closest relative.

Additional collections examined: **Costa Rica. Alajuela:** wooded slopes of Volcán Poás from rim of crater to a distance 2 mi down road towards Varablanca, ca. 8200 ft, 28 Jan 1971, *Wilbur & Teeri 13647* (DAV, DS, DUKE, F, GH, LL, MICH, MO, NY, PMA, TEX). **Heredia:** woods around the Laguna del Barba at 2800 m and on slopes down to ca. 2500 m, 18 Dec 1974, *Wilbur & Luteyn 18375* (DUKE). **Cartago:** upper crest of Volcán Irazú covered with many feet of volcanic ash and bare except for scattered shrubs, 6 May 1971, *Wilbur 14199* (DUKE, F, MO); trail to top of Volcán Turrialba from Finca Quemado between 2800–3200 m, 10 May 1971, *Wilbur 14328* (DUKE); oak dominated slopes ca. 14 km SE of El Empalme, 2600 m, 18 July 1977, *Wilbur et al. 22873* (DUKE, NY). **San José:** roadside slopes ca. 3.4 km SE of La Georgina and 10 km SE of El Asunción, ca. 2750 m, 1 Aug 1977, *Wilbur et al. 23689* (DUKE, NY). **Puntarenas:** Cordillera de Talamanca, 1–3 airline km S of the peak of Cerro Echandi, 9°00'30"-9°01'30"N, 82°49'W, 2500–2800 m, 9 Mar 1984, *Davidse et al. 25492* (DUKE, MO, NY). **Limón:** Cordillera de Talamanca, oak forest at headwaters of the unnamed western branch of the Río Teribe, between Río Sini and the continental divide at Cerro Bekom, 9°10'45"N, 83°03'30"W, 2500–2600 m, 21 & 27 Mar 1984, *Davidse et al. 26142* (CAS, DUKE, MO). **PANAMA. Bocas del Toro:** Cordillera de Talamanca, páramo at main peak of the Cerro Fabrega Massif, 9°07'N, 82°52'40"W, 3100–3300 m, 6 and 8 Mar 1984, *Davidse et al. 25305* (DUKE, MO). **Chiriquí:** forested ridges S of Finca Lerida, 6000–7000 ft, 26 Jul 1947, *Allen 4768* (F, GH, MO, NY, US); western slope of Volcán Chiriquí on open slopes, ca. 9800 ft, *Wilbur et al. 11027* (DS, DUKE, GH, MICH, MO).

7. **Vaccinium cordifolium** (M. Martens & Galeotti) Hemsley, Biol. Centr. Amer. Bot. 2:274. 1881, where mistakenly printed as *cordatum* – see explanation following description below.

Gaylussacia cordifolia M.Martens & Galeotti, Bull. Acad. Brux. 9:530. 1842, *non Vaccinium cordifolium* Stapf (1894). TYPE: MEXICO. VERACRUZ: "croît sur les laves du Pedregal de las Vigas, près de Xalapa, entre 6 et 7,000 pieds d'élévation," *Galeotti 1795* [HOLOTYPE: BR! (photo NY; barcode BR-S.P 825 928); probable ISOTYPES: BR! (barcode BR-S.P. 825 936), G! (photo F neg. 26634), K! (photo NY neg. 10619)]. The sheet annotated as Holotype by Sleumer in 1965, at BR, has no field locality data on the hand-written label other than "Gay-lussacia cordifolia Nobis. Coll. Galeotti No. 1795." Other handwriting of the labels on the specimens of *Galeotti 1795* at BR, G, and K appears to be similar, based on availble photographs at NY, but the language and exact wording may differ somewhat (i.e., BR Isotype = "Pedregal de las Vigas 6–7000"; G = "sur les laves près Xalapa a 7000"; K = "on the lavas near J[sic]alapa at 7000 ft.").

Vaccinium matudae Lundell, Phytologia 2:4. 1941 [as *matudai*; orthography corrected as advised in ICBN Recommendation 60 C.1.a]. TYPE: MEXICO. CHIAPAS: Barranca Honda, Siltepec, growing on rocks, 2600 m, Oct–Nov 1940, *Matuda 4074* (HOLOTYPE: MICH!; ISOTYPES: A! photo NY neg. 9630, CAS! NY!).

Epiphytic or terrestrial *shrubs*, sometimes arising from lignotubers; branchlets stout, rather irregularly angulate, slightly hirtellous but soon glabrate, reddish. *Leaf-blades* persistent, stiffly coriaceous, evergreen, broadly ovate or oblong-ovate, 2.5–5(–8) cm long, (1.3–)2–3.5(–5) cm broad, apically rounded to subacute, basally shallowly cordate to rounded, marginally subentire to prominently crenate-serrate, glabrous, lustrous, the venation pinnate, slightly elevated above and somewhat more prominently elevated and reticulate beneath; petioles 2–4.5 mm long, ca. 1.5 mm in diam., glabrous or at most very sparingly pilosulose. *Inflorescences* racemose or paniculate, 6–40-flowered, when paniculate then short-pedunculate and to ca. 8 cm long; rachises 3–6 cm long, 1–1.5 mm in diam., glabrous to weakly short-pilose or hirtelous; floral bracts caducous, lanceolate, ciliate, ca. 1.7–3.2 mm long; pedicels erect to secundly nodding, 5–10 mm long; bracteoles nearly basal, lanceolate, ca. 1–2.2 mm long. *Flowers* 5-merous; calyx 4.8–5.3 mm long, conspicuously articulate with pedicel, the tube obconic to campanulate, 2–3.5 mm long, deep rose, glabrous, the lobes deltoid, acute, 1–1.8 mm long, glabrous, non-ciliate; corolla with aestivation imbricate, membranous, unistratose, cylindric to urceolate, 5–8 mm long, whitish tinged with deep pink or rose, glabrous externally, the lobes deltoid, subacute to rounded or obtuse, ca. 1–1.3 mm long; stamens 10, included, 6.5–7 mm long, the filaments ca. 3–4.7 mm long, proximally ciliate, the anthers 3.5–4.2 mm long, lacking spurs, the thecae ca. 1.5–2.2 mm long, pappilose, the tubules ca. 1–2.5 mm long, dehiscing by short, introrse clefts. *Berry* ca. 5–6 mm in diam., 5-locular.

Distribution.—Pine-oak forests, cloud forests, and montain thickets and forests, from the Mexican states

of Vera Cruz through Oaxaca and Chiapas, and mountainous northern Guatemala (Huehuetenango and Quiché departments), between 2000–3100 m. Flowering and fruiting: throughout the year.

Vaccinium cordifolium is characterized by its stiffly coriaceous, broadly cordate leaves with margins subentire to crenate, its racemose (or rarely paniculate) inflorescence, a calyx that is articulate with the pedicel, stamens that lack spurs, and a dark rose to pink corolla.

Vaccinium matudae Lundell, a most distinctive species was first described as *Gay-Lussacia cordifolia* Martens & Galeotti (21842), but was later determined to be a *Vaccinium* by Hemsley (1881). In attempting to form the new combination based on Martens and Galleotti's binomial, he instead unfortunately published *Vaccinium cordatum* (1881), mistakenly, and carelessly also citing the basionym as *Gaylussacia cordata* Mart. & Gal., Bull. Acad. Brux. 9:529. 1842. As a result, instead of establishing the intended and needed binomial in *Vaccinium*, Hemsley created an illegitimate name (Article 52 of the ICBN) that is to be rejected as nomenclaturally superfluous. When Hemsley published *Vaccinium cordifolium*, there would have been no obstacle to proposing the binomial *Vaccinium cordifolium* based on Martens and Galeotti's binomial, but after 1894 *Vaccinium cordifolium* Stapf had been published (Trans. Linnean Soc. Ser. II. 4:189. 1894) and therefore a combination based on Martens and Galeotti's binomial would have resulted in a later homonym. However, when querried on this problem, three very experienced and knowledgable nomenclaturalists (Drs. J. McNeill, G. Moore, and D. Nicolson) all agreed that Hemsley's carelessness in transfering *Gaylussacia cordifolium* M.Martens & Galeotti into *Vaccinium* as *V. cordatum* (M.Martens & Galeotti) Hemsley, while also mistakenly citing the basionym as *G. cordatum*, should nevertheless be treated as a correctable error rather than as the publication of a later invalid synonym that Lundell corrected by publishing a new name since by that time *Vaccinium cordifolium* Stapf had been published for a species from Borneo. Consequently, the American species will be known as *V. cordifolium* (M.Martens & Galeotti) Hemsley as originally intended, while the Borneoan plant is provided with a binomial in the footnote below[1].

Additional collections examined: **MEXICO. Veracruz:** Municipio de Las Vigas; en las faldas del Volcancillo, por la carretera federal Jalapa-Las Vigas, 19°38'N, 97°03'W, 2000 m, 16 Aug 1979, *Calzada 5483* (F); Las Vegas, *Linden 420* (MICH); bosque de piño, 2300 m, El Volcancillo, 2300 m, 21 Jan 1976, *Ortega et al. 114* (F, NY). **Oaxaca:** wet hardwood montane forest, Hwy. 175 ca. 31 mi N of Ixtlán de Juarez, 7500 ft, 20 Dec 1972, *Almeda & Luteyn 1675* (DUKE). **Chiapas:** evergreen cloud forest on the N and W slopes of Cerro Mozotal below the microwave tower along the road from Huixtla to El Porvenir and Siltepec, 3000 m, 30 Dec 1972, *Breedlove & Thorne 31178* (DS, DUKE, MICH, MO, NY, RSA); Niquivil, Municipio de Motozintla, 2786 m, 15 May 1945, *Matuda 5497* (DS, LL, MICH). **GUATEMALA. Huehuetenango:** Sierra de Cuchumatanes, on slope with *Pinus*, *Quercus* and *Drimys*, 6 mi N of Santa Eulalia along road to San Mateo Ixtatán, 9200 ft, 5 Feb 1965, *Breedlove 8593* (DS, F); top of Cerro Chemalito, 3.5 mi W of Santa Eulalia, 3100–3150 m, *Steyermark 49946* (F, NY).

8. Vaccinium breedlovei L.O. Williams, Fieldiana Bot. 31:173. 1965. TYPE: GUATEMALA. HUEHUETENANGO: Sierra de los Cuchumatanes, 6 mi N of Santa Eulalia along road to Santa Eulalia, 2800 m, Feb 1965 (fl), *Breedlove 8594* (HOLOTYPE: F! photo NY neg. 9247; ISOTYPE: DS!).

Vaccinium tolbertianum Lundell, Wrightia 5:87. 1975. TYPE: GUATEMALA. EL QUICHÉ: El Boquerón in mossy secondary thickets, 8000–8200 ft, 10 Aug 1964 (im fr), *Proctor 25479* (HOLOTYPE: LL! ISOTYPE: LL!).

Epiphytic *shrubs*; branchlets irregularly angled to ± terete, glabrous, reddish-brown. *Leaf-blades* persistent, coriaceous, evergreen, ovate to ovate-lanceolate, 5–15 cm long, 2.5–8 cm broad, apically acuminate to acute or rarely even rounded, basally rounded, marginally very finely but distinctly and minutely glandular crenate with the teeth 6–9 mm apart, glabrous on both surfaces, the venation pinnate, prominent on both surfaces and pronouncedly elevated thru the third order of branching forming a conspicuous reticulum, the midrib depressed into the upper surface forming a channel; petioles stout, 4–11 mm long, puberulous. *Inflorescences* axillary or arising from leafless nodes, racemose or paniculate (2–4 branches), often pronouncedly secund, 10–20-flowered, glabrous throughout; rachises 3–7 cm long; floral bracts scale-like, triangular to narrowly deltoid, 1–1.5 mm long, glabrous; pedicels slender, (5–)7–9 mm long, glabrous; bracteoles medially or more

[1]**The species from Borneo, rendered by the above interpretation a later homonym is here named Vaccinium beamanianum Wilbur & Luteyn, nom. nov. based on *V. cordifolium* Stapf (Trans. Linnean Soc. Ser. II. 4:189. 1894). The specific epithet recognizes Professor John H. Beaman, a native of the mountains of western North Carolina, for decades an outstanding professor at Michigan State University, who has devoted recent decades to making better known the flora of Borneo.**

distally attached, narrowly triangular to linear-lanceolate, 1.5–2 m long. *Flowers* 5-merous; calyx ca. 3–4 mm long, articulate with pedicel, the tube campanulate, terete, slightly constricted near summit, ca. 1.5–2.2 mm long and 2 mm in diam., glabrous, the limb somewhat flaring, the lobes rounded to somewhat deltoid to triangular, usually abruptly acuminate, ca. 1–1.5 mm long, glabrous; corolla with aestivation weakly imbricate, membranous, unistratose, broadly funnelform, strongly 5-angulate with pronounced medial nerves, 5–6 mm long, flaring distally to 6–7 mm in diam., glabrous, greenish to greenish-white often suffused with maroon, the lobes triangular, 2–2.5 mm long; stamens 10, included, ca. 5–5.5 mm long, the filaments ca. 3 mm long, glabrous, the anthers ca. 3 mm long, lacking spurs, the thecae ca. 2 mm long, papillate, the tubules ca. 0.8–1.5 mm long and 0.2 mm in diam., dehiscing by terminal, obliquely slanting pores; ovary 10-locular (?); styles ca. 5 mm long. *Berry* not seen.

Distribution.—Known only from four collections on forested slopes of pine, oak, and *Cupressus*, from Chiapas (Mexico) and Lempira (Honduras), at ca. 2300–2670 m. Flowering: Dec–Feb.

Vaccinium breedlovei is characterized by large (to 15 × 8 cm), glabrous leaves that are finely crenate margined and prominently, reticulately and pinnately veined, racemose to paniculate inflorescences, a calyx that is articulate with the pedicel, anthers lacking spurs, a greenish corolla, and possibly falsely 10-locular ovaries (mature fruits are needed). Although unable to make better suggestions as to the closest relatives of the very distinctive *Vaccinium breedlovei*, we do not see the close relationships with *V. poasanum* and the relatives of that species (sect. *Leptothamnia* Benth. & Hook.f.) as originally suggested by Williams. The inflorescence pattern would seem to argue against any close relationship with species centered around *V. poasanum*, although the stamens do suggest such a relationship.

Vaccinium tolbertianum Lundell was named from perhaps two incomplete collections made by the same collector at about the same time and place in Guatemala. The specimens (both LL) consisted of attached leaves, stems, and young fruits. The most unusual feature was the presence of coarse, stiff, rigid trichomes on a few centimeters of older stem on two of the six sprigs and on a few nearby leaves. Nothing like those trichomes has been seen in Meso-American vaccinia, but they are frequent in the genus *Gaultheria*. Other than for the presence of these gland-tipped trichomes, the specimens would fit reasonably well within the current concept of *V. haematinum* Standley & Steyermark. It seems they can still be best placed there in spite of the presence of those unique trichomes. Obviously further collecting may change our understanding of this little known variant. Specimens with flowers and trichome-bearing stems are unknown and it seems reasonable to conclude that without the presence of those coarse trichomes on a few centimeters of certain of the older branchlets, the species never would have been proposed.

Additional collection examined: **MEXICO. Chiapas:** broad ridge with evergreen cloud forest on the third ridge along logging road from Las Margaritas to Campo Alegre, 2300 m, 8 Dec 1986, *Breedlove & Mally 66262* (CAS). **HONDURAS. Lempira:** Montaña de Celaque, S of Río Arágual, 2670 m, 29 May 1991, *Davidse 34869* (MO).

9. Vaccinium chihuahuense Wilbur & Luteyn, sp. nov. (**Fig. 1**). TYPE: MEXICO. CHIHUAHUA: Mojarachic, 1 Jun 1939, *Knobloch 5791* (HOLOTYPE: US! photo NY neg. 13031; ISOTYPE: MSU! NY frag. ex US!).

Vaccinium lepidum Camp, ined. in herb.

Frutex. Rami pilosuli vel glabrati; ramuli pilosuli, tereti. Folia ut videtur persistens, elliptica, 10–15 mm longi et 3–8 mm lati, crenulato-serrulati, pilosulosi vel puburuli utrinque; petiole 1–2 mm longi, pilosuli. Inflorescentia racemosa, axilaria, 4–9 mm longa; rhachis puberulenta; bractae et bracteolae caducae, 1–2 mm longae; pediceli 1.5–4.5 mm longi, puberulenti. Caylx pedicellis articulatus, ca. 3.2–3.5 mm longus; tubi puberulenti; limbi calycis (0.8–)2–2.4 mm longi et 1.5–2 mm diam., puberulenti; lobi calycis 5, acuti, acuminati, erecti, ca. 1–1.9 mm longi et 0.8 mm lata basi, puberulenta; corolla alba vel carnea, 3.5–5 mm longi and 2–2.5 mm diam., pilosulosi; lobi corollae ca. 1 mm longi, erecti, oblongi.

Terrestrial *shrubs*, 0.8–1.3 m tall; mature branchlets terete, striate, moderately to densely pilosulose with the hyaline trichomes ± spreading at right angles to the stem's surface branchlets, to even glabrate, the bark thin, grayish to brownish, splitting longitudinally and exfoliolating; twigs sharply and narrowly angled, striate, moderately to densely pilosulose. *Leaves* apparently persistent, coriaceous, evergreen, the blades flat to concave, elliptic to ovate-elliptic, 10–15 mm long, 3–8 mm broad, apically acute to broadly rounded,

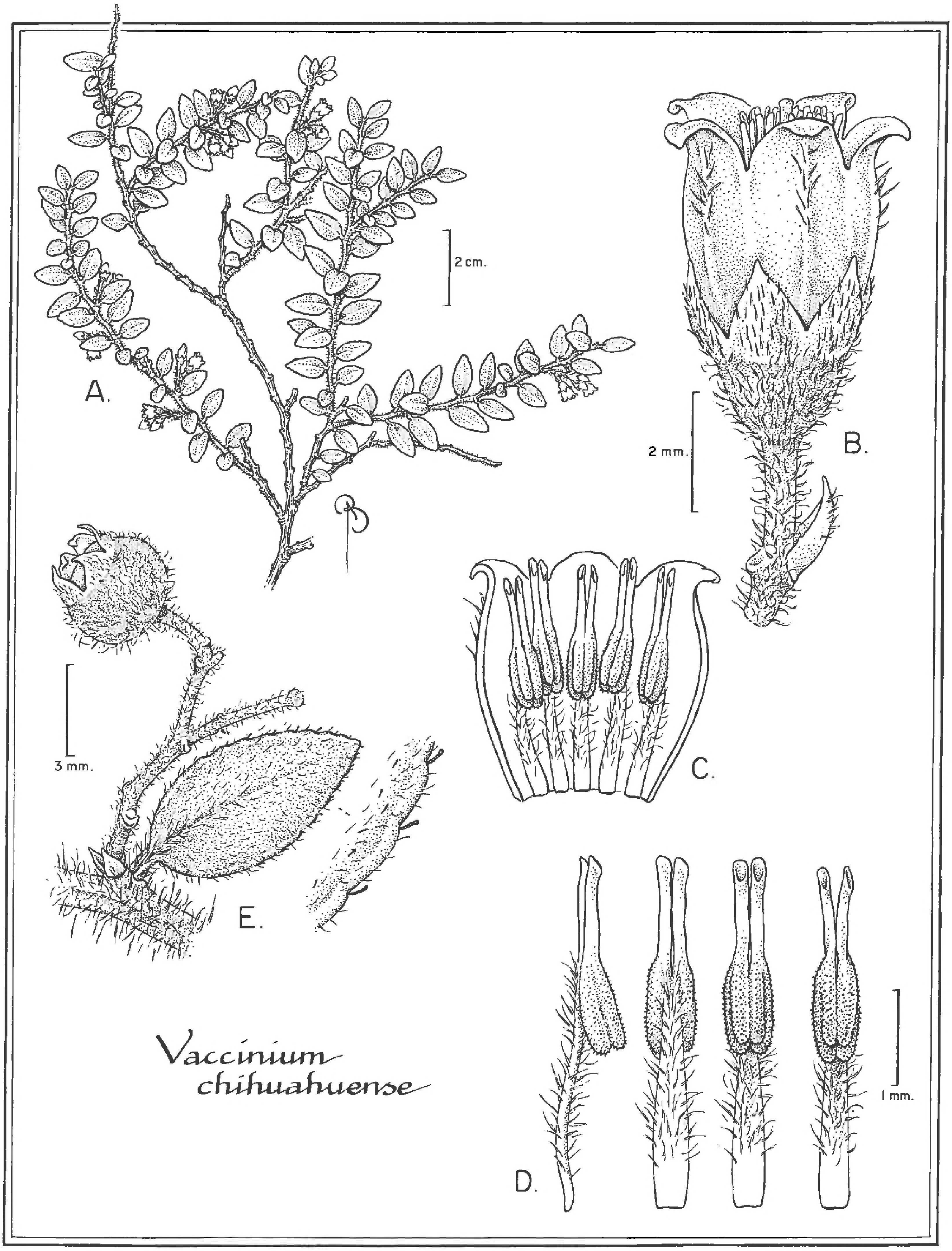


FIG. 1. *Vaccinium chihuahuense* Wilbur & Luteyn. A, habit. B, flower showing pubescence. C, corolla opened to show orientation of 5 stamens. D, stamens showing side, ventral, and two dorsal views with introrse, oblique dehiscence pores. E, portion of stem showing leaf, old inflorescence, and immature fruit, with inset showing crenate leaf margin (drawn from type collection).

basally cuneately tapering to broadly rounded, marginally indistinctly crenulate-serrulate with the teeth terminating in a reddish, gland-tipped vein extension (glandular fimbriae), both surfaces densely puberulent or pilosulose with hyaline, spreading trichomes, the lower surface deciduously glandular-fimbriate, the venation pinnate, inconspicuous to conspicuous above, the midrib impressed above and raised beneath, the secondary and tertiary venation impressed above; petioles somewhat flattened and canaliculate above, 1–2 mm long, densely pilosulose. *Inflorescences* axillary, racemose, 2–8-flowered; rachises ca. 4–9 mm long, moderately short-puberulent; floral bracts and bracteoles caducous, oblong, acute to obtuse, 1–2 mm long, ± glabrous; pedicels 1.5–4.5 mm long, densely puberulent. *Flowers* 5-merous; calyx ca. 3.2–3.5 mm long, articulate with pedicel, the tube ca. 1–1.5 mm long, ca. 1 mm in diam., moderately to densely puberulent, the limb (0.8–)2–2.4 mm long, densely puberulent, the lobes erect, narrowly triangular to ovate, acute to shortly acuminate, ca. 1–1.9 mm long, ca. 0.8 mm broad at base, puberulent; sinuses acute; corolla with aestivation imbricate, membranous, unistratose, cylindric, angled opposite the lobes, 3.5–5 mm long, ca. 2–2.5 m in diam., whitish-pink, externally sparingly to moderately pilosulose especially distally along angles, the lobes erect, oblongish, roundedly acute, ca. 1 mm long; stamens 10, included, ca. 2.7 mm long, the filaments ca. 1.7–1.8 mm long, pilosulosely ciliate to densely pilosulose, the anthers ca. 1.5 mm long, lacking spurs, the thecae ca. 0.5–0.7 mm long, ± smooth, the tubules distinct, ca. 0.8–1 mm long, dehiscing by introrse, oblique, tear-shaped pores; styles glabrous, ca. 4–5.5 mm long. *Berry* not seen.

Distribution.—Known only from several collections in forest of *Quercus-Pinus* with thin, rocky, litosol soils, from the state of Chihuahua, Mexico, at 1950–2200 m. Flowering: Jun–Aug; fruiting: Oct.

Vaccinium chihuahuense is characterized by having persistent pubescence in nearly all parts, small leaves that are marginally crenate-serrulate, an articulate calyx, anthers that lack spurs. Morphologically it resembles *V. confertum*, from which it differs most conspicuously in its persistent, dense pubescence of all vegetative and floral parts.

Additional collections examined: **MEXICO. Chihuahua:** Mojarachic, Jan 1937 (st), *Knobloch 5736* (MSU); Parque Nacional Cascada de Basaseachic, Mpio. de Ocampo, 2200 m, 12 Mar 1994 (st), *Garcia et al. 2527* (NY), 2100 m, 3 Oct 1986 (im fr), *Spellenberg et al. 8701* (NMC), 1950 m, 5Aug 1994 (fl), *Yen & Estrada 2841* (DUKE, NMC, NY); Divisadero Overlook of Cascada de Basaseachic, 2100 m, 23 Jun 1987 (fl), *T. R. Van Devender et al. 87-160* (NMC); Mpio. de Guachochic, Cascada de Cusarare, 28 Jul 1973 (fl), *Bye 4400* (NMC).

10. Vaccinium lundellianum L.O. Williams, Fieldiana Bot. 31:173. 1965. (Based on *Malea pilosa* Lundell, non *Vaccinium pilosum* A. Chevalier ex Dop., 1930).

Malea pilosa Lundell, Amer. Midl. Naturalist 29:484. 1943. TYPE: MEXICO. CHIAPAS: Mt. Malé, near Porvenir, 3200 m, 6–12 Jul 1941, *Matuda 4614* (HOLOTYPE: MICH!; ISOTYPES: A! photo NY neg. 9675, CAS! LL! NY! photo NY neg. 9632).

Epiphytic *shrubs*; branchlets terete, ± blackish, ± pilosulose throughout with whitish trichomes. *Leaf-blades* persistent, coriaceous, evergreen, oblong to lance-oblong or even lanceolate, 3–4.5(–7.5) cm long, 0.8–2(–3) cm broad, apically obtuse to subacute, basally usually rounded, marginally entire or nearly so, occasionally with a few, remote glandular teeth, somewhat shiny above and dull beneath, persistently pilose beneath and puberulent or pilosulose above at first but glabrescent with age, the venation pinnate, visibly reticulate on both surfaces with the midrib and primary veins elevated; petioles ridged and grooved, 2.5–8 mm long, densely pilosulose. *Inflorescences* axillary, solitary, racemose, congested, ca. 2–6-flowered; rachises subsessile, mostly 2–5 mm long, densely pilosulose, bearing small, imbricate bracts at base; floral bracts persistent, deltoid, ca. 1–1.2 mm long, pilosulose; pedicels slender, 3–7 mm long, pilosulose; bracteoles persistent, basal or attached below the middle, opposite to subopposite, lanceolate to linear, 1.5–1.6 mm long. *Flowers* 5-merous; calyx ca. 3–3.3 mm long, sharply articulate with pedicel, the tube subcampanulate to ± globose, ca. 1.5 mm long, densely pilosulose, the lobes narrowly deltoid, acute, ca. 1.3–1.7 mm long; corolla with aestivation imbricate, membranous, unistratose, subcylindric, pentagonal, slightly swelling above, 8–10 mm long, white, pilosulose externally, the lobes erect or nearly so, obtuse, 2–3 mm long; stamens 10, included, 8.5–9.6 mm long, the filaments 6.3–7.2 mm long, pilosulose, at the base weakly attached to corolla, attached to the anthers dorsally near the middle, the anthers ca. 3.5–4 mm long, lacking spurs, the thecae ca. 2–2.3 mm long including the attenuate base, the tubules slender, ca. 1.6–2 mm long, dehiscing

by introrse clefts; styles slightly exserted. *Berry* spherical, at least 4 mm diam. when immature, pilosulose, glabrate, falsely 10-locular.

Distribution.—Known only in cloud forests, from a few collections from the Mexican state of Chiapas and the Guatemalan states of Huehuetenango and San Marcos, between 2000–3000 m. Flowering:Jul; fruiting: immature Jan.

Vaccinium lundellianum is characterized by its oblong to lanceolate, entire-margined and pilose leaves to 4.5(–7.5) cm long, congested racemes, pilosulose inflorescences (including the rachis, pedicel, calyx, corolla, and fruit), relatively long corollas (8–10 mm long), and a falsely 10-locular berry.

Additional collections examined: **MEXICO. Chiapas:** steep slopes with evergreen cloud forest, NW slope of Cerro Malé, 3–4 km W of El Porvenir along road from Huixtla to Siltepec, 19 Sep 1976, *Breedlove 40381* (F, CAS, MO, NY, RSA, TEX); sobre arboles altos, Rodeo-Siltepec, 2000 m, 29 Apr 1964, *Matuda 37378* (F, MO). **GUATEMALA. Huehuetenango:** Sierra de los Cuchumatanes, La Sierra (Tujimach), across river from San Juan Atitán, 2500–2900 m, upper forested slopes, 8 Sep 1942, *Steyermark 52017* (F). **San Marcos:** montane cloud forest area on outer slopes of Tajumulco Volcano, ca. 8–10 km W of San Marcos, ca. 2300 m, 31 Dec 1964, *Williams et al. 26886* (F, NY). **HONDURAS. Atlantida:** Pico Bonito National Park, 2435 m, *T. Hawkins 920* (MO).

11. **Vaccinium selerianum** (Loes.) Sleumer, Notizbl. Bot. Gart. Berlin-Dahlem 13(116):124. 1936.

Pernettya seleriana Loes., Bull. Herb. Boiss. ser. II. 3:217. 1903. TYPE: MEXICO. CHIAPAS: "in distr. del Centro," in silva montaña inter San Cristóbal Las Casas et Huitzán," 10 Mar 1896, *Seler & Seler 2126a* (HOLOTYPE: B†, photo F neg. 4597; ISOTYPE: GH!, photo NY neg. 11118).

Vaccinium haematinum Standley & Steyermark, Field Mus. Nat. Hist., Bot. Ser. 23:139. 1944. TYPE: GUATEMALA. HUEHUETENANGO: Cerro Huitz, between Mimanhuitz and Yulhitz, Sierra de Cuchumatanes, 1500–2600 m, 14 Jul 1942, *Steyermark 48572* (HOLOTYPE: F! photo F neg. 52552 and NY neg. 9656).

Vaccinium minarum Standley & Steyermark, Field Mus. Nat. Hist., Bot. Ser. 23:219. 1947. TYPE: GUATEMALA. ZACAPA: middle and upper southern slopes of Volcán Gemelos, Sierra de las Minas, 2100–3200 m, 26 Jan 1942, *Steyermark 43295* (HOLOTYPE: F! photo F neg. 52553 and NY neg. 9657; ISOTYPE: US! photo NY neg. 11119).

Vaccinium hondurense A.C. Smith, Ceiba 3:185. 1953. TYPE: HONDURAS. MORAZÁN: San Juancito Mts., ca. 6 km W of San Juancito, Rancho Quemado on rotting stumps in rain forest, 2100 m, 8 Jul 1852 [1952], *L.O. Williams 18567* (HOLOTYPE: US! photo NY neg. 9443; ISOTYPES: DS! F! GH!).

Vaccinium quicheanum Lundell, Wrightia 5:86. 1975. TYPE: GUATEMALA. EL QUICHÉ: Nebaj, 8000 ft, in pineland, 13 Jun 1964, *Contreras 4983* (HOLOTYPE: LL!).

Epiphytic or terrestrial, bushy *shrubs* or rarely small *trees* (0.5–)1–3(–4.5) m tall; branchlets ridged and grooved and somewhat angular to nearly terete, when young often reddish but becoming brown or even blackish-brown in age, at first glabrous to more typically moderately to even densely puberulent and then later becoming glabrate. *Leaves* often numerous and overlapping, the blades persistent, coriaceous, evergreen, narrowly to broadly elliptic to oblong-elliptic or even obovate-oblong to even lanceolate, 2–4.5(–6.5) cm long, (0.8–)1.2–2.5(–5) cm broad, apically acute to obtuse or even broadly rounded to tapering to an ultimately obtuse apex, basally rounded to acutely cuneate, marginally remotely and inconspicuously to conspicuously crenate-serrulate, often lustrous especially above, glabrous or nearly so on both surfaces to moderately although inconspicuously and finely puberulent to pilosulose, the venation pinnate, the midrib flush above or basally somewhat elevated but mostly somewhat channeled while beneath ± elevated, the lateral veins above ± flush with the surface while beneath either flush or elevated and often conspicuously so and then forming a reticulum; petioles subterete, often canaliculate above, rugose, 1.5–5 mm long, glabrous or puberulent to short-pilose. *Inflorescences* axillary, racemose, 6–12-flowered; peduncles and rachises together 3–12 mm long, sparsely to moderately puberulous; floral bracts caducous to deciduous, narrowly triangular to oblongish, often concave, (1.5–)2–7 mm long, shortly ciliate, ± scarious, externally glabrous or medially ciliate; pedicels reflexed or turned downwards, 1.5–5(–9) mm long, puberulent; bracteoles medially to distally placed, alternate, appressed, caducous to deciduous, broadly elliptic to lanceolate, 2–3.5 mm long, sparingly indistinctly ciliate, occasionally externally medially short-pilose. *Flowers* 5-merous; calyx 3–4.5 mm long, conspicuously articulate with pedicel, the tube spherical to oblong-cylindric, 1.5–2.2 mm long, glabrous to densely puberulent or pilosulose, the lobes deltoid to narrowly triangular, acute, (0.8–)1.2–1.8 mm long, externally and internally glabrous to externally moderately puberulent to pilosulose, marginally glabrous to minutely ciliate and often sparingly and inconspiciously glandular; corolla with aestivation imbricate,

membranous, unistratose, cylindric, 5–7.2(–9) mm long, ca. 3 mm in diam., deep rose to pinkish or white, glabrous both externally and internally or moderately to densely pilosulose externally, the lobes broadly oblong to deltoid, obtuse to acute, ca. 1–2 mm long; stamens 10(–12), included, 3.7–7(–7.7) mm long, the filaments 2.3–5(–5.7) mm long, attached dorsally to the lower third or half of the anther, flattened, densely ciliate, the anthers 1.8–4 mm long, lacking spurs, the thecae ca. 1.3–2.2 mm long, minutely papillose, the tubules slender 0.7–2.2 mm long, dehiscing by short, oblique pores or short clefts. *Berry* terete, 5–9 mm diam., reddish during maturation but apparently blackish at maturity, glabrate to sparingly pilosulose, 4–5-locular.

Distribution.—Oak forests, evergreen cloud forests, and mossy thickets, in southern Mexico (Oaxaca and Chiapas), south through Guatemala (El Quiché, Huehuetenango, and Zacapa) into Honduras (Lempira and Morazán) and El Salvador (Santa Ana), from 1600–3200(–3700) m. Flowering: (Jan)May–Aug(Dec); fruiting: throughout the year.

Vaccinium selerianum is a morphologically variable species characterized by its congested leaves that are elliptic to oblong-elliptic to lanceolate, 2–4.5 cm long, with margins crenate-serrate, short-racemose inflorescences, an articulate calyx, glabrous to pilose corollas, anthers that lack spurs, and a 4–5-locular ovary.

Recently, as exemplified by the treatment in the *Flora of Guatemala* (L.O. Williams *in* Standley & Williams 1966), two species have been recognized within what is treated here as a single species of *Vaccinium*. They are separated there by the following straightforward couplet:

Flowers glabrous ____ **V. haematinum**
Flowers densely pubescent ____ **V. minarum**

The brief descriptions there indicate that the calyces of *V. haematinum* vary from "sparsely and minutely puberulent or glabrate." Specimens have been examined with glabrous or at least glabrate calyces and pilosulose corollas. The leaves and vegetative features of both "species" seem to have the same range of variation. It cannot be claimed that a morphological continuum exists between the two extremes, but the variation exhibited by the small sample available suggests that a much larger sample would in all probability further blur the supposed distinctions between the named extremes. It seems that only one, not extremely polymorphic species is represented. The extremes in pubescence of the calyx seem to be rather widely bridged, but there seems to be no similar blurring in corolla pubescense; those previously assigned to *V. minarum* have densely pubescent corollas while those attributable to *V. haematium* are glabrous.

The flowers on the type specimens of *V. minarum*, *V. quicheanum*, and *V. hondurense* are exactly similar as to pubescence, although the leaves of *V. quicheanum* are more elongate, while those of *V. minarum* are smaller and narrower. As far as the long list of names is concerned, *V. selerianum* (Loes.) Sleumer (1936) has priority.

Additional collections examined: **MEXICO. Oaxaca:** dry wooded slopes and ravines surrounding Llano Verde ca. 12 km ESE of Ixtlán de Juarez, 17°18'N, 96°22'W, 2000–2400 m, 6 Jun 1970, *Graham & Frohlich 1101* (MICH); vicinity of Cerro Zempoaltepetl, openings of *Cupressus-Pinus* woodland, ca. 5 km E of summit, 2800 m, 9 Aug 1950, *Hallberg 884* (MICH); rainforest along road between Ixtlán and Valle Nacional, just below summit at Cerro Pilón, 17°35'N, 96°30'W, ca. 8000 ft, 20 Jun 1969, *Webster & Breckon 15350* (GH). **Chiapas:** steep forested slopes on the SE side of Cerro Tres Picos and the ridges near summit, 2100–2500 m, 28 May 1972, *Breedlove 25443* (DS, DUKE, MICH, MO, NY, RSA); evergreen cloud forest along logging road from Las Margaritas to Campo Alegre, 2300 m, 24 Oct 1976, *Breedlove 41099* (DS, MICH, MO). **GUATEMALA. El Quiché:** El Boquerón; in mossy cloud forest, 8000–8200 ft, *Proctor 25435* (MO). **Huehuetenango:** Sierra de los Cuchumatanes, near small stream in pine forest between Km 324 & 325 on Ruta Nacional 9N between Chemal and San Juan Ixcoy, 3140 m, 4 Aug 1959, *Beaman 3051* (MSC); steep rocky slopes along road to San Juan Ixcoy, 3700 m, 12–23 Jan 1966, *Molina et al. 16438a* (F, NY, US). **Zacapa:** on summit between Loma El Picacho and Cerro de Moños, 2000–2600 m, 16 Jan 1942, *Steyermark 42836* (F, US). **HONDURAS. Lempira:** Sierra de Celaque, encima de un filo, 2750 m, 18–22 Nov 1974, *Hazlett 2262* (F, MO). **Morazán:** frecuente en la floresta humeda y nebulosa de Montaña La Tigra, entre El Piliguin y Prado de Fatima, 1800 m, 30 Dec 1962, *Molina R. 11217* (F, LL, NY, US). **EL SALVADOR**. **Santa Ana:** bosque nebulosa, de Montaña Montecristo, 2300 m, 23 May 1963, *Molina R.. 12683* (F, LL, NY, US).

12. Vaccinium talamancense (Wilbur& Luteyn) Luteyn, Brittonia 53:444. 2001. *Macleania talamancensis* Wilbur

& Luteyn, Brittonia 29:263, fig.3. 1977. TYPE: COSTA RICA. SAN JOSÉ: along trail from Canaan to Chirripó via Los Angeles, N of Río Talari, 3200–3400 m, 19–22 Jan 1970, *Burger & Leisner 7401* (HOLOTYPE: DUKE!; ISOTYPES: F! MO! NY!).

Terrestrial *shrubs*, 0.5–1 m tall; mature branchlets terete, striate, glabrous; twigs subterete, bluntly and broadly compressed, puberulent to densely short-pilose, glabrate. *Leaves* imbricate, the blades persistent, coriaceous, evergreen, obovate to more typically oblong-elliptic, 2.5–4.7 cm long, 1.2–1.8(–2.3) cm broad, apically acute or rounded but with a 1–2 mm long apiculus, basally rounded, marginally indistinctly and minutely serrulate, the actual margin a lighter color and seemingly a bit thinner than lamina proper, essentially glabrous above except finely whitish, appressed-pilosulous near the base along midrib and inconspicuously ciliate especially proximally, indistinctly and sparingly whitish, appressed-pilosulous beneath basally and also bearing appressed, reddish-brown, glandular-fimbriae ±0.2 mm long, provided with 1–2 reddish, circular basal glands, the venation pinnate with 3–4 arcuate-ascending lateral nerves per side, the midrib slightly thickened and raised proximally but impressed distally, lateral nerves impressed above, all veins prominently elevated beneath and of a lighter color than lamina proper; petioles thick, flattened or broadly canaliculated above and slightly winged throughout, rugose, 2–3 mm long, moderately puberulous to short-pilose. *Inflorescences* axillary, racemose, 10–15-flowered; rachises strongly and sharply angled, 1–2(–4) cm long, pilose with soft, short, white trichomes; floral bracts appressed, linear to lanceolate 3–4 mm long, puberulent; pedicels 6–10 mm long, softly pilosulous or puberulous, bearing distally a series of glandular fimbriae; bracteoles basal, appressed, linear to narrowly lanceolate, 2–3 mm long, puberulent, marginally glandular-fimbriate, without dorsal glands. *Flowers* 5-merous; calyx 4.5–5 mm long, articulate with pedicel, the tube campanulate to cylindric, ca. 2.5–3 mm long and in diam., longer than limb, moderately puberulous with whitish trichomes ±0.1–0.2 mm long, the lobes triangular, acute, 1.2–1.8 mm long, puberulous externally and internally; corolla with aestivation apparently valvate, membranous, weakly bistratose, cylindric, terete, 8–13 mm long, 4–6 mm broad, pink to red, appressed- to spreading-puberulous externally with moderately abundant hyaline trichomes ± 0.4 mm long, moderately to densely pilose with hyaline trichomes within, the lobes strongly reflexed, triangular, 1.5–2 mm long, pink to red although sometimes becoming pale pink to whitish, densely pilosulous both externally and internally; stamens 10, included, 7–7.5 mm long, the filaments 3.5–4 mm long, glabrous proximally but marginally with appressed-pilosulous hyaline trichomes distally, the anthers 4.5–5 mm long, lacking spurs, the thecae 1.8–2 mm long, smooth, basally strongly incurved, the tubules 2.5–2.7 mm long, dehiscing by oblique pores ca. 0.6 mm long; styles exserted. *Berry* spherical, 8–10 mm diam., blue-black, short-pilose, 5-locular.

Distribution.—Known only in upper oak forests and disturbed páramo habitats, from the upper slopes of Cerro Chirripó, from ca. 2500–3819 m. Flowering: Jan, Mar–Apr; fruiting: Dec, Mar–Apr.

Vaccinium talamancense is characterized by its leaves with blade margins indistinctly and minutely serrulate, red to pink corollas that are appressed- to spreading-puberulous externally and moderately to densely pilose internally, anther connectives that lack spurs, and a pilose berry that is not glaucous. Its interspecific relationships are uncertain at this time.

Additional collections examined: **COSTA RICA. San José:** Cordillera de Talamanca, Cerro Chirripó massif; forest just below the páramo with many dead trees and many ericaceous shrubs, 3200 m, *Davidse & Pohl 1594* (DUKE, MO); Parque Nacional Chirripó, Cuenca Térraba-Sierpe, base of Cerro Crestones, 3460 m, 7 Dec 1996 (fr), *Alfaro 1011* (MO); Pacific slope, trail to Cerro Urán, 3000 m, 7 Apr 1995 (fl), *González 662* (INB); sendero de las Machinas, Monte Sin Fe, 2590 m, 18 Mar 1999 (fl, fr), *Luteyn & Chaverri 15415* (CR, INB, NY); trail beyond Río Talari to Valle de Los Leones, 3200–3300 m, 20 Mar 1999 (fl, fr), *Luteyn & Chaverri15430* (AAU, CAS, CR, DUKE, F, INB, K, MEXU, MO, NY, TEX, US); Sabana de Los Leones, Cerro Lohmann, 3200 m, 26 Jan 1996 (fl), *Morales 5177* (F, INB, NY); between La Piedra and lower refugio, 17–28 Mar 1976 (fl), *Weston 10134* (CR).

13. Vaccinium floribundum Kunth in H.B.K., Nov. Gen. Sp. Pl. 3:266, t. 251. 1818. TYPE: PERU. AMAZONAS: "Crescit in montanis Peruviae, prope Carxamarca, alt. 1700 hex. Floret Augusto," *Humboldt & Bonpland* s.n. (HOLOTYPE: P-HBK! ISOTYPES: B-Willd. 7353-1! P!).

Densely branched, terrestrial *shrubs* 2–8(–12) dm tall, sometimes arising from lignotubers to 10 cm in diam.; branchlets few, angled to terete, glabrous or puberulent. *Leaf-blades* persistent, coriaceous, evergreen,

highly variable in shape and size from very broadly ovate or nearly orbicular to elliptical or ovate-oblong, 0.4–1.5(–2.5) cm long, 0.3–1.2 cm broad, apically acute to obtuse, basally rounded to somewhat cuneate, marginally thickened and ± revolute and shallowly crenate-serrulate, occasionally inconspicuously and sparingly spreading pilosulose above and this pubescence more abundant basally and ± glabrate except for the moderate to dense puberulence along the midrib, the lower surface glabrous to moderately beset with appressed to somewhat ascendent, glandular trichomes and these appearing as punctate dots as the trichomes drop away, the venation pinnate; petioles flattened above, 2–3(–4) mm long, very shortly puberulent. *Inflorescences* axillary, racemose (very rarely weakly paniculate), 6–10-flowered; rachises strongly angulate, 1–2(–4.5) cm long, puberulent to glabrous or very nearly so; floral bracts broadly ovate to oblong, 2.5–4.5 mm long, (2–)3–4.5(–5.5) mm broad, minutely appressed puberulent on the abaxial surface to nearly glabrous, minutely ciliate and occasionally glandularly ciliate; pedicels 3–4(–6) mm long, usually spreading puberulous but occasionally glabrate; bracteoles medially to basally attached, ± ovate to lance-ovate or even narrowly lunear-oblong, 2.5–4.8 mm long, 1.5–2.5 mm broad slightly appressed puberulous externally to glabrate, marginally minutely ciliate and occasionally also slightly glandular-ciliate. *Flowers* 4–5-merous; calyx ca. 3–4 mm long, sharply articulate with pedicel, the tube campanulate to short-cylindric, 1.5–1.8 mm long, 1.2–1.8 mm in diam., glabrous, the lobes deltoid to ovate-oblong, acute, ca. 1–1.5 mm long, glabrous, usually ciliate; corolla with aestivation imbricate, membranous, unistratose, cylindric, 5–6.5 mm long, 2–3 mm in diam., white to roseate, glabrous, the lobes ± erect, deltoid, acute, ca. 1.5 mm long, glabrous; stamens 8 or 10, included, 3.8–6 mm long, the filaments 2–2.5 mm long, flattened, densely spreading ciliate with hyaline trichomes, the anthers 2.5–3.5 mm long, lacking spurs, the thecae 1–1.5 mm long, densely papillate or sharply and minutely spinulose, the tubules 1.5–2 mm long, dehiscing by introrse, oblique pores. *Berry* spherical, ca. 4–6 mm in diam., dark bluish-black, sometimes reddish when immature, 4–5-locular.

Distribution.—Disjunct from the South American Andes. Mossy thickets of the highest reaches of the Talamancas of Costa Rica, at 1400–3450 m. Flowering: Feb–Apr, Oct; fruiting: Feb–Mar.

Vaccinium floribundum is characterized by its small leaves the blades of which are pinnately nerved and minutely crenate-serrate margined, racemose inflorescences with small white to pink flowers, spurless connectives, and glaucous berries. In Costa Rica the stamens lack spurs, whereas populations in South America have at least vestigial spurs. *Vaccinium floribundum* is most closely related to *V. consanguineum*, as mentioned herein.

Additional collections examined: **COSTA RICA. San José:** Cerro de la Muerte, Cerro Sábila, 80 m N of summit, 3400 m, 28 Mar 1985, *Horn 131* (WIS); wet páramo thicket, Cerro de las Vueltas, 2700–3000 m, 1 Jan 1926, *Standley & Valerio 43697* (US); Buenavista Massif, summit of Cerro Sákira, 3417 m, 29 Aug 1969, *Weston 6005* (F); Parq. Nac. Chirripó, Valle de Los Conejos, 3500–3600 m, 19 Mar 1999, *Luteyn & Chaverri 15417* (AAU, CAS, INB, NSW, NY, STE, TEX). **Puntarenas:** páramo on the international border, Cerro Echandi, 9°02', 82°49'W, 3050–3160 m, 22 Aug 1983, *Davidse et al. 23856* (MO). **Limón:** Cordillera de Talamanca, Cerro Kamuk, 9°16'N, 83°02'30"W, 3200–3350 m, 24 Mar 1984, *Davidse et al. 25979* (MO).

14. Vaccinium confertum Kunth in H.B.K., Nov. Gen. Sp. Pl. 3:265, t. 250. 1818. TYPE: MEXICO. "prope Moran et Cerro de Oyamel, alt. 1400 hex," *Bonpland 4099* (HOLOTYPE: P-HBK! frag. F! ISOTYPES: B†, B-Willd. 8314-1! P!). The isotype in the Willdenow Herbarium has the label as "*Humboldt & Bonpland 4099*."

Vaccinium eriocladum Dunal, DC. Prodr. 7:571. 1839. *Vaccinium confertum* var. *eriocladum* (Dunal) Sleumer, Notizbl. Bot. Gart. Berlin 13:128. 1936. TYPE: MEXICO. VERACRUZ[?]: inter Tampico et Real del Monte, 20 May 1827, *Berlandier 254* (HOLOTYPE: G-DC! photo NY s.n., frag. NY!; ISOTYPES: B†, BM!, F!, OXF!, P(x4)!, W!). There are three sheets at P, one is incorrectly annotated as the holotype of *V. eriocladum* by Sleumer in 1958; it and another sheet at P both have the "ex. 12" written on the label too. Then there are two other *Berlandier 254* collections at P and one at OXF, none of which have the "ex. 12" on the label. All sheets are definitely *V. confertum*!

Vaccinium brachystachyum Benth., Pl. Hartweg. 65. 1840. TYPE: MEXICO. OAXACA: "in montibus Carmen in jugo la Sierra dicto," *Hartweg 480* (HOLOTYPE: K-Herb. Benth.!, frag. US!, photo NY neg. 11116; ISOTYPES: CGE (x2)! K-Herb. Hook.! NY! OXF! P!).

Vaccinium discolor M.Martens & Galeotti, Bull. Acad. Brux. 9:531. 1842. TYPE: MEXICO: "sur les pics élevés de la cordilière orientale d'Oaxaca (Cerro de Capulalpan, Pelado de San Andres, etc.) , entre 7,500 et 9,500 pieds," *Galeotti 1818* (HOLOTYPE: BR!; ISOTYPES: BR, 2x! F! NY, 2x! P, 2x! US! photo NY neg. 11117, W! photo F neg. 31963). The labels on the *Galeotti 1818* isotype sheets at BR (one of them), F, NY, and US give "Oaxaca, Llano Verde" as the locality. Of the sheets at BR, the one labeled as "TYPUS" has the locality as "(Oaxaca) Sierra 7000"; another unannotated isotype has no locality data on its label, and the third isotype has "Oaxaca, Llano Verde."

Pernettya ovata Fernald, Proc. Amer. Acad. 36:496. 1901. TYPE: MEXICO. CHIAPAS: mountain woods between San Cristóbal Las Casas and Huitztlán, 10 Mar 1896, *Seler & Seler 2126b* (HOLOTYPE: GH! photo NY s.n.).

Densely branched, terrestrial *shrubs*, 2–6(–10) dm tall; branchlets strongly ridged and grooved and hence appearing angulate, very densely puberulent or pilosulose to shortly hirsutulose (or reportedly very rarely glabrous). *Leaf-blades* persistent, thick-coriaceous, evergreen, oval to oblong-ovate, 6–15(–30) mm long, 4–10(–15) mm broad, apically acute to somewhat rounded, basally rounded, marginally finely but conspicuously crenate-serrulate, the upper surface finely and inconspicuously pilosulose to glabrate, deep green and shining while beneath pale and usually with scattered, inconspicuous, appressed, gland-tipped trichomes, the venation pinnate; petioles semicircular, canaliculate above 1–2(–3) mm long, puberulent to pilosulose. *Inflorescenses* axillary, densely compact, racemose, 3–7-flowered, almost always shorter than the subtending leaf; rachises mostly 8–12 mm long; floral bracts caducous, cuculate, oblong, ca. 2–4 mm long; pedicels (1–)2–3(–4) mm long, finely short-pubescent; bracteoles basal, caducous, cuculate, oblong, 1.2–1.5 mm long. *Flowers* 4–5-merous; calyx 3–3.3 mm long, conspicuously articulate with pedicel, the tube campanulate or globose, ca. 1–2 mm long and in diam. at anthesis but enlarging to ca. 3(–4) mm in diam. in fruit, glabrous, the lobes deltoid, acute, ca. 1–1.5 mm long; corolla with aestivation imbricate, membranous, unistratose, cylindric to weakly cylindric-campanulate or weakly cylindric-urceolate, 4–6.5 mm long, white to pinkish; stamens 10, included, 4.7–6.4 mm long, the filaments (1.5–)2.4–3.5 mm long, ciliate, the anthers 3.2–3.6 mm long, lacking spurs (or rarely bearing dorsally 2, minute, vestigial spurs), the thecae ca. (1–)1.4–2 mm long, the tubules ca. (1–)2–2.3 mm long. *Berry* 4–6 mm in diam., bluish or blackish with a glaucous bloom, 4–5-locular.

Distribution.—Montane forested slopes of pine-oak, rocky meadows, and clearings, from northern Mexico (Chihuahua, Tamaulipas, San Luis Potosi, Nayarit, Aguascalientes, Queretaro, Hidalgo, Vera Cruz, Puebla, Mexico, Jalisco, Guerrero, Oaxaca, and Chiapas), south into Guatemala (Chimaltenango, Huehuetenango, Quetzaltenango, San Marcos, Solola, and Totonicapan) and Honduras (Comayagua, Lempira, Olancho, and Ocotopequez), at 1538–4038 m. Flowering: throughout the year but especially in Jan–Jun; fruiting: throughout most of year but especially in Mar–Aug.

Vaccinium confertum is characterized by small, more or less concave leaves, 6–15 mm long (rarely to 30 mm long) with finely crenate-serrulate margins, densely compact racemose inflorescences of 3–7 flowers that are usually shorter than the subtending leaves, an articulate calyx, anthers that lack spurs (or are rarely vestigial), and a glaucous, 4–5-locular ovary. Its similarities with *V. chihuahuense* are mentioned above.

Additional representative collections examined: **MEXICO. Chihuahua:** pine-oak woods in mountains between Nabogame and Guadalupe and Calvo, 7200 ft, 12 Oct 1959, *Correll & Gentry 23048* (LL, NY); Sierra Madre, 15 mi E of Batopilas, 1–2 Oct 1898, *Goldman 183* (GH, US); Lagotera, 5–6000 ft, 21 Jul 1965, *Pennington 95* (TEX). **Tamaulipas:** large, loose rock formation near Rancho Gómez Farias, Apr 1960, *Duke M3543* (AAU, MO, NY). **San Luis Potosí:** San Luis Potosí, 6000–8000 ft, *Parry & Palmer 56l* (F, GH, MO, NY, PH, US); Cerro Grande, 8 km al NW de Guadalcazar, 2100 m, 19 Jun 1955, *Rzedowski 5960* (F, MO, TEX). **Nayarit:** bosque en barranca, 1.5 km al S de Santa Teresa del Nayar, Municipio de Jesús Maria, 8 Jun 1978, *Diaz L. 954l* (MICH). **Aguascalientes:** Sierra del Laurel, near the Jalisco-Aguascalientes border, ca. 10 mi SE of Calvillo, oak forests near summits, 2500–2700 m, 26–28 Aug 1960, *McVaugh 18445* (MICH). **Queretaro:** ladera de cerro con bosque de coniferas, 2 km al SW de Pintal de Amoles, 2400 m, *Fernández 2710* (MO, NY). **Hidalgo:** bosque de pino y encino, alrededores de Zacualtipán, 1 Feb 1964, *Gonzales Q. 311* (DUKE, MICH, MSC, TEX); bosque de encino, 1.5 km al SSW de Tezuantla, 2950 m, 29 Jun 1975, *Medina 472* (CAS, NY). **Veracruz:** on old lava, La Joya, Perote, 6500 ft, 23 Sep 1938, *Balls 5519* (NY); Peñas-Largas, cerca de Tezoantla, Municipio de Real de Monte, 2750 m, 21 Apr 1966, *Rzedowski 22171* (DS, F, LL). **Puebla:** pine-oak woodland, 74 kms S of the Puebla-Orizaba Rd. (Mex. 150) on road to Nicolas Bravo, 2560 m, 15 Apr 1985, *Grimes 2809* (CAS, MO, NY, TEX); bosque de piño y encino, ca. 1 km al NE de Honey, sobre la terraceria a Pahuatlán, 2050 m, 13 May 1978, *Perino 3336* (CAS, F, MO, WIS); wet ledges of river bluffs below Trinidad Iron Works, 5700 ft, 25 Apr 1904, *Pringle 8911* (A, CAS, CU, F, GH, LL, MIN, MO, MSC, NY, PH, US). **México:** barranca, Distr. Temascaltepec, 18 Feb 1935, *Hinton et al. 7389* (DS, F, LL, MO, NY, US). **Jalisco:** along logging road from El Chante to El Guisar in the Sierra de Manantlán, 2160 m, 17 Aug 1980, *Breedlove & Almeda 45724* (CAS, NY); trail from Real Alto to San Sebastián, 2000 m, 3 Feb 1927, *Mexia 1630* (A, CAS, DS, F, GH, MICH, MIN, MO, NY). **Guerrero:** Vertiente SW del Cerro Teotepec, ca. 17°29'N, 100°12'W, 2900 m, 29 Jan 1965, *Rzedowski & McVaugh 231* (CAS, MICH, MSC). **Oaxaca:** near Tres Cruces S of San José El Pacifico, 10 Feb 1945, *Alexander 665* (MICH, NY); top of the mountain, Zepoaltepetl, 19–27 Feb 1937, *Camp 2649* (DUKE, NY, US); Distrito de Ixtlán; Municipio de Comaltepec, 0.5 km from Hwy. 175 on road to Cerro Humo Chico, 3000 m, 23 Feb 198l, *Martin 341* (CAS, MSC, MO); Cerro Pelón, Municipio de Comaltepec, 2950 m, *Rzedowski 28855* (CAS, MICH, TEX, US). **Chiapas:**

steep slope, evergreen cloud forest on the N and W slope of Cerro Mozotal below the microwave tower along the road from Huixtla to El Porvenir and Siltepec, 30 Dec 1972, *Breedlove & Thorne 31182* (DS, LL, MO, RSA); Mount Hueitepec, 3 mi NW of San Cristóbal de las Casas, 7100–7500 ft, 25 Mar 1949, *Carlson 1582* (F, MICH, NY); Mt. Tacana, 2000–4038 m, Aug 1938, *Matuda 2363* (A, F, MICH, NY, US). **GUATEMALA. Chimaltenango:** north side of Volcán de Fuego, ca. 3600 m, 6 Aug 1960, *Beaman 4024* (GH, MSC); Volcán Acatenango, crater, 13,240 ft, 7 Feb 1907, *Kellerman s.n.* (US); Buena Vista above Tecpán, 10,000 ft, 25 Mar 1933, *Skutch 339* (A, US). **Huehuetenango:** Sierra de los Cuchumatanes, between Chemal and San Juan Ixoy and kms 324 and 325 on Ruta National 9 N, ca. 3140 m, 4 Aug 1959, *Beaman 3053* (DUKE, GH, MSC, NY, TEX, US). **Quetzaltenango:** uppermost ridge of summit of Volcán Zunil, 3000–3800 m, 22 Jan 1940, *Steyermark 34861* (F). **San Marcos:** trail from San Sebastián to Tajamulco volcano, cloud forest near summit, 14 Aug 1979, *Boeke & Utzschneider 2900* (NY); Cerro El Bonete, S of Volcán Tajumulco, 11 Mar 1971, *Plowman 3055* (GH, TEX). **Sololá:** mountain slopes above Santa María, 10,500 ft, 14 April 1937, *Muenscher 12363* (CU, F). **Totonicapán:** ca. 21 km E of Totonicapán at km 153 on Ruta Nacional 1, ca. 3260 m, 8 Aug 1959, *Beaman 3123* (GH, MSC, TEX, US); in moist bank of María Tecun, 3000–3600 m, 12–23 Jan 1966, *Molina R. et al. 16380a* (F, NY, US); summits of Sierra María Tecum between Los Encuentros and Totonicapán, 3200 m, *Williams 14269* (F, GH, MO, US). **HONDURAS. Lempira:** Montaña de Celaque, 2650 m, 18–22 Nov 1974, *Hazlett 2266* (MO). **Ocotepequez:** Cerro El Capitán, 10 km E of Belén Gualcho, 2–15 Apr 1977, *Nelson et al. 4016* (MO). **Olancho:** alrededor de la Picucha, 13 km NE de Catacamas en el Parque Nacional de Agalta, 2 June 1992, *Mejiá Darío 149* (DUKE).

15. Vaccinium wilburii Almeda & Breedlove, Brittonia 44:50. 1992. TYPE: MEXICO. GUERRERO: ridge with *Pinus, Quercus, Clethra* and *Cleyera*, W of Puerto El Gallo along road to Toro Muerto, 2530 m, 9 Oct 1986 (fl), *Breedlove & Almeda 65040* (HOLOTYPE: CAS!; ISOTYPES: DUKE! MEXU, MICH, MO! photo NY neg. 13045, NY!).

Epiphytic, erect to pendent *shrubs* with branches 1–2 m long, arising from swollen lignotubers up to 2 dm in diam.; upper branchlets ridged and grooved and there densely spreading puberulent, lower ones becoming terete and glabrate. *Leaves* densely arranged with most internodes ca. 4–7 mm long, the blades persistent, coriaceous, evergreen, lanceolate to lance-elliptic, mostly 2–3.4 cm long, (5–)7–14 mm broad, apically acute the tip itself often blunt, basally broadly cuneate to obtuse, marginally indistinctly and bluntly crenate-serrate, with a narrow, thickened and elevated border, the venation pinnate, with all veins conspicuously elevated on both the upper and lower surfaces at least when dried; petioles subterete, flattened to canaliculate above, 2–4 mm long, puberulent to glabrate. *Inflorescences* axillary, loosely racemose, sometimes corymbose, 5–10-flowered; rachises sharply angled, 1.5–2.5 cm long, glabrous or nearly so; floral bracts narrowly lanceolate to linear, scarious, 2–3 mm long, marginally ciliate; pedicels sharply angled, ca. (8–)12–14 mm long, ca. 0.5 mm in diam., glabrous or nearly so; bracteoles submedial, narrowly lanceolate to linear, scarious, 1.5–2.2 mm long, distally ciliate. *Flowers* 5-merous; calyx ca. 5 mm long, articulate with pedicel, glabrous, the tube ca. 1.5–2.5 mm long, ca. 2 mm in diam., the lobes narrowly triangular to deltoid, acute, ca. 2–2.5 mm long; corolla with aestivation imbricate, membranous, unistratose, cylindric-urceolate, angulate, 7.6–10 mm long, ca. 4 mm in diam., pink, glabrous externally, the lobes ± oblong, obtuse 1–1.5 mm long; stamens 10, included, ca. 6 mm long, the filaments 2.5–3 mm long, flattened, attached medially to anthers, glabrous to ciliolate, the anthers ca. 4–4.2 mm long, lacking spurs, the thecae ca. 1.5–2.3 mm long, slightly papillose, the tubules slender, distinct, ca. 1.6–2.2 mm long and 0.1–0.2 mm in diam., dehiscing by introrse, oblique, terminal pores; styles ca. 11 mm long. Mature *berry* unknown, but at least 5 mm diam. when immature.

Distribution.—Known now only from the montane, pine-oak forests of the Sierra Madre del Sur of the Mexican state of Guerrero, at ca. 2500–3000 m. Flowering and fruiting: Jul, Oct.

Vaccinium wilburii is characterized by its lanceolate to lance-elliptic leaves, glabrous calyx with comparatively long lobes, and uniformly pink cylindric-urceolate corollas that are angulate and glabrous throughout. Although we have not studied this species in the field, the suggestions of Almeda and Breedlove (1992), who stated that the relationships of this species seem to lie with *V.selerianum* (*V. haematinum* to them) and to a lesser extent with *V. lundellianum*, are herein followed.

Additional collections examined: **MEXICO. Guerrero:** Distr. Galeana, Piedra Ancha, oak and pine forest, 3000 m, 29 Jul 1939, *Hinton et al. 14508* (NY, US); Sierra Sur, Mpio. Metlatónoc, Xatu Yahta, al W de Coicoyán (Oaxaca), terrenos de Atzompa, 17°15'N, 98°20'W, 2600 m, 20 Aug 1989, *A. de Avila 737* (CAS).

16. Vaccinium jefense Luteyn & Wilbur, Brittonia 29:272. 1977. *Symphysia jefensis* (Luteyn & Wlbur) vander Kloet, Taxon 53:97. 2004. TYPE: PANAMA. PANAMÁ: at the top of Cerro Jefé, 1000 m, 5 Jun 1973 (fl), *Luteyn & Kennedy 3955* (HOLOTYPE: DUKE!; ISOTYPES: MO! NY!).

Lianoid epiphytes or arching terrestrial *shrubs* to 2 m tall; branchlets subterete, glabrous, green becoming reddish-brown, drying brown, the bark thin, cracking into longitudinal strips; twigs subterete, glabrous to densely hirsute distally. *Leaf-blades* persistent, coriaceous, evergreen, elliptic or ovate-elliptic, (4.5–)8–12(–20) cm long, (2–)3–7(–8.5) cm broad, apically acuminate to short-acuminate, basally rounded and cordate to subcordate, marginally entire, dark green above and paler beneath, drying olive to grayish-brown, glabrous above, sparsely to moderately hirsute beneath along the principal veins, the lower surface also with numerous, minute, glandular fimbriae, the venation 5–7(–9)-plinerved or sometimes appearing weakly pinnate with 3 pairs of lateral nerves, the veins impressed above and raised beneath (i.e., the leaves somewhat bullate), proximal 1–2 cm of midrib conspicuously thickened above; petioles terete, rugose, 5–9 mm long, 2–3.5 mm in diam., hirsute to glabrate. *Inflorescences* axillary (rarely appearing terminal), racemose or subcorymbose, (6–)8–17-flowered; rachises subterete, 1–1.5 cm long, glabrous or sparsely hirsute, densely glandular-fimbriate; floral bracts linear-lanceolate, conspicuously nerved, (2.5–)3–9 mm long, ca. 1 mm broad, hirsute, glandular-fimbriate; pedicels terete, striate, ca. (6–)14–26 mm long, 1 mm in diam., sparsely hirsute, densely glandular-fimbriate; bracteoles linear-lanceolate, (2.5–)5–8 mm long, ca. 0.5 mm wide, hirsute, glandular-fimbriate. *Flowers* 5-merous; calyx 6–10 mm long, articulate with pedicel, sparsely to moderately hirsute and glandular-fimbriate, the tube cylindric, conspicuously bluntly and roundedly 10-ribbed or fluted, slightly angled opposite the sinuses, 2–4 mm long, 2–5 mm in diam., the limb campanulate, 4–6 mm long, the lobes oblong to ovate, acute, often basally slightly imbricate, (2–)4.5–6 mm long, 1.7–3 mm broad, conspicuously nerved; corolla with aestivation valvate, thinly fleshy, weakly bistratose, cylindric, 10–13.5 mm long, 5.5–10 mm in diam., green, sparsely hirsute and glandular-fimbriate especially on the surface of the lobes, the lobes triangular, 2–4 mm long and broad; stamens 10, included, ca. 8–10 mm long, the filaments distinct, ca. 2.5–4 mm long, broadest basally, marginally densely sericeous especially on the connective, translucent when fresh, the anthers ca. 7–8 mm long, lacking spurs, orangish-brown when fresh, the thecae ca. 3–3.7 mm long, strongly incurved at the base, papillose, the tubules ca. 3.5–5 mm long, sparsely pilose along inner surfaces, dehiscing by latrorse clefts ca. 1.5–2 mm long; styles included, 9–10 mm long, glabrous. *Berry* spherical, ca. 12 mm in diam., purple, 5-locular.

Distribution.—Elfin forests, densely moss-draped thickets of shrubs and small trees on mountain summits and upper slopes, in Panama from Chiriquí thru Panamá provinces, at 750–1400 m. Flowering: Jan–Jul and sporadically through the rest of the year; fruiting: throughout most of the year.

Vaccinium jefense is characterized by its weakly bullate leaf blades that are basally rounded and subcordate to cordate, conspicuous leaf nervation, glandular-fimbriate (sometimes densely) inflorescences, long and narrow bracteoles, elongate and conspicuously striate calyx limb and lobes, sparsely hirsute corollas (especially on the lobes), and anther tubules that are sparsely long-pilose along the inner surfaces and dehisce by latrorse clefts. It resembles several other green-flowered species of *Vaccinium* and its morphological relationships are mentioned below in the discussion of *V. furfuraceum*.

Additional collections examined: **PANAMA. Chiriquí:** Fortuna, camino de quebrada Bonita, hacia el este del Río Chiriquí, 1150 m, 7 Apr 1987, *Valdespino et al. 560* (NY). **Veraguas:** ridge of Cordillera de Tute, along trail to Cerro Tute, 3–4 km past Escuela Agrícola Alto de Piedra, just W of Santa Fé, premontane and montane rainforest, 8°32'N, 81°07'W, 800–1400 m, 20 Mar 1982, *Knapp & Kress 4367* (MO). **Coclé:** near sawmill above El Copé, ca. 3000 ft, 4 Apr 1978, *Hammel 2363* (MO). **Panamá:** 1 mi después de La Eneida cerca de Cerro Jefé, ± 750 m, 8 Aug 1968, *Correa & Dressler 955* (DUKE, MO, PMA); La Eneida, region of Cerro Jefé, 12 Jul 1968, *Dressler 3541* (DUKE, MO, PMA); path beyond the village of La Eneida, ca. 1000 m, 2 Jul 1970, *Lutyen & Foster 1124* (DUKE, F, MO, US); top of Cerro Jefé, 9 Jul 1966, *Tyson et al. 4344* (DUKE, MO, SCZ).

17. Vaccinium furfuraceum Wilbur & Luteyn, Sida 21:1609, fig. 2. 2005. TYPE: COSTA RICA. LIMÓN: Cantón de Talamanca, fila de exploración minera entre Río Sukut y Río Carbri, Muragubishi, 9°22'50"N, 82°56'50"W, 700 m, 14 July 1989 (fl), *G. Herrera 3286* (HOLOTYPE: INB!; ISOTYPES: DUKE! F! NY).

Much-branched, epiphytic, lianoid *shrubs;* branchlets ± terete, finely ridged and grooved, densely spreading hirsutulous, 1.5–4 mm in diam. *Leaf-blades* persistent, coriaceous, evergreen, ovate to ovate-elliptic, (2.5–)4–6 cm long, (1.2–)1.8–2.5 cm broad, apically acuminate and ± tapering abruptly to the narrowly rounded tip, basally rounded, marginally entire, glabrous above or nearly so except moderately pilose along

the principal veins, moderately to densely spreading pilose beneath along the principal, secondary and even tertiary veins with hyaline trichomes up to 0.7 mm long and also densely beset especially when young with short, thick, glandular, scale-like trichomes ca. 0.1–0.2 mm long on both the veins and the surface, the venation weakly 5-plinerved, the secondary nerves joining together in a series of prominent arches, the lamina ± bullate, the midrib and secondary veins impressed above and elevated beneath and the tertiary veins slightly elevated on both surfaces; petioles 2–3(–4) mm long, densely spreading pilose. *Inflorescences* axillary, congregated distally, sometimes appearing terminal, racemose but with the rachis often contracted and the flowers hence appearing somewhat corymbose, 3–10(–12)-flowered, 2.5–5 cm long overall; rachises (2–)4–8 mm long, densely glandularly strigillose with thickened trichomes 0.1–0.3 mm long and sparingly to moderately pilosulose with hyaline spreading trichomes 0.3–0.6 mm long; floral bracts narrowly lanceolate to linear-lanceolate, 2.5–2.6 mm long, marginally glandular ciliate; pedicels (0.6–)1–2(–2.4) cm long, moderately to densely glandularly strigillose and also sparingly pilosulose with hyaline trichomes; bracteoles located in about proximal third, appressed, linear-lanceolate, glandular ciliate, ca. 2.8 mm long. *Flowers* 5-merous; calyx 3–4.5 mm long, strongly articulate with pedicel, the tube shallowly obconic, ca. 1.5 mm long, ca. 5–6 mm in diam. distally, pronouncedly flaring from the approximately 3 mm in diam. basal portion, densely and scurfily glandular-squamate throughout, the limb ca. 3 mm long, the lobes deltoidly triangular to broadly oblongish with an abrupt distal tip, ca. 1–1.2 mm long, ca. 2.3 mm broad at base; corolla with aestivation valvate, thinly fleshy when fresh but membranous when dry, bistratose, broadly cylindrical, relatively thin in texture, 8–12 mm long, ca. 8 mm in diam. distally, densely scurfily glandular-squamate externally, glabrous internally, the lobes triangular, acute, 2.5–3 mm long, ca. 3 mm broad basally; stamens 10, included, ca. 7–9.5 mm long, the filaments 2–3 mm long, conspicuously hyaline ciliate, flattened, the anthers ca. 7 mm long, lacking spurs, the thecae 2–2.2 mm long, basally incurved, papillose, the tubules ca. 3–5 mm long, dehiscing by latrorse, elongate clefts ca. 1–2 mm long; styles about as long as the corolla, straight, glabrous. *Berry* not seen.

Distribution.—Known only from the type collection made in Costa Rica in the Talamanca foothills of Limón Province, at ca. 700 m. Flowering: Jul.

Vaccinium furfuraceum is characterized by its generally densely glandular-fimbriate leaf blades and floral parts, thin-petiolate leaves with blades that are bullate, apically short-acuminate, and basally rounded, plinerved venation with the reticulate veinlets conspicuously raised beneath, short calyx lobes, thin and membranous corollas that are cylindric-campanulate, and staminal tubules that are pubescent along the inner surfaces and dehiscent latrorsely. The corollas are proportionally conspicuous with respect to the calyx. Its morphological relationships lie near *V. monteverdense* and *V. jefense* with which it has in common pilose inner surfaces of the staminal tubules and latrorse dehiscence. It also shares densely fimbriate leaves and inflorescence parts with *V. jefense*, perhaps its closest relative. *Vaccinium furfuraceum* differs most conspicuously from *V. jefense* by its possession of an overall shorter calyx (3–4.5 mm long vs. 6–10 mm) and calyx lobes (1–1.2 mm long vs. 4.5–6 mm), inconspicuously apophysate (not 10-ribbed) calyx tube, and non-striate calyx limb and lobes.

18. Vaccinium luteynii Wilbur, Sida 21:1612, fig. 3. 2005. TYPE: PANAMA. BOCAS DEL TORO: Fortuna Dam-Chiriquí Grande Road, 2–3 km N of the Continental Divide, ca. 8°48"N, 82°12'W, 700–760 m, disturbed, steep roadside slopes, 15 Oct 1998 (fl), *Luteyn et al. 15322* (HOLOTYPE: PMA!; ISOTYPES: AAU, CAS, DUKE, E, G, MO, NY, SCZ, TEX, US).

Terrestrial or epiphytic *shrubs* to 4 m tall; branchlets terete, tan to dull reddish-brown, glabrous. *Leaves* subopposite, the blades persistent, coriaceous, evergreen, ovate to oblong-ovate or ovate-elliptic, ca. 5–15 cm long, 3–6 cm broad, apically acute to somewhat acuminate, basally rounded to almost subclasping, marginally entire and slightly thickened and revolute, glabrous or very nearly so on both surfaces, the venation 3–5 (7)-plinerved with lateral nerves arising from proximal 1/4–1/3 of midrib, midrib proximally much thickened and weakly elevated in basal ¼ above, then thinner and weakly impressed becoming flush to slightly elevated near apex, lateral nerves weakly impressed to flush proximally above but soon slightly elevated distally, reticulate veinlets elevated above, all venation somewhat elevated beneath throughout;

petioles stout, 1–5 mm long, glabrous. *Inflorescences* axillary (often appearing terminal), corymbose racemes, mostly 5–8 cm long overall, 10–13-flowered, with a glabrous to very sparingly and minutely puberulent peduncles; rachises 1.5–4.5 cm long; floral bracts persistent, triangular or lanceolate, scale-like, 2–2.5 mm long, glabrous but often marginally, minutely ciliate; pedicels irregularly angulate or ridged, 20–40 mm long, ca. 0.6–1 mm in diam., glabrous; bracteoles at or very near the base, persistent, subopposite, lanceolate to narrowly triangular, 1.2–2 mm long, glabrous or minutely ciliate. *Flowers* 5-merous; calyx 4–4.2 mm long, articulate with pedicel, the tube subcylindric, deeply and bluntly rugose, ca. 1 mm long, 4–4.5 mm in diam., glabrous, the limb smooth above but broadly and saccately spurred opposite and below each lobe, ca. 3 mm long, the spurs solid (not hollow) and sometimes slightly and broadly bilobed, the lobes triangular, acute, 0.6–1 mm long, glabrous; corolla with aestivation valvate, thick and somewhat fleshy, bistratose, broadly urceolate to urceolate-campanulate, ca. 10 mm long, ca. 8 mm broadest diam. when fresh, but drying 5–8 mm long and ca. 6 mm in diam. just beneath the throat and 3.5–4 mm in diam. just above the calyx, green, externally glabrous and internally densely pilose with sordid, white trichomes especially in the throat and lobes, the lobes acute, ca. 3 mm long; stamens 10, included, ca. 6.5 mm long, the filaments 3.5–4 mm long, long-pilose in distal half, attached to the anther dorsally slightly above its middle, the anthers ca. 3.5 mm long, lacking spurs, golden, the thecae ca. 2–2.5 mm long, densely and finely papillose, the lower third strongly incurved, the tubules ca. 1 mm long, dehiscing by introrse, strikingly oblique pores. *Berry* not seen.

Distribution.—Montane rainforests in Panama, along the continental divide, between Bocas del Toro and Chiriquí, at 700–950 m. All specimens yet seen were collected in flower in Mar.

Vaccinium luteynii is characterized by its subopposite leaves, glabrous leaf blades with rounded to almost subclasping bases, saccately 5-spurred calyx limb, thick, fleshy, broadly urceolate to urceolate-campanulate corollas that are internally densely pilose at the throat and onto the lobes, and glabrous stamens that dehisce introrsely. The interspecific relationships of *V. luteynii* are uncertain at this time, although it is morphologically similar to *V. bocatorense* and *V. floccosum*.

Additional collections examined: **PANAMA. Bocas del Toro:** along road between Florida and Chiriquí Grande, 1.2 mi N of Continental Divide, 5.3 mi N of bridge over Fortuna Dam, 8°44'N, 82°17'W, 910 m, 12 Mar 1985, *Croat & Grayum 60459* (DUKE, MO, NY, PMA, WIS); forest along the Gualaca-Chiriquí Grande road, 31.7 km S of Chiriquí Grande and 15.7 km N of Sitio de Presa, ca. 8°49'N, 82°12'W, 1070 m, *Luteyn 14831* (BRIT, COL, DUKE, MO, NY, P, PMA, SCZ, W); Fortuna Dam-Chiriquí Grande road, 2–3 km N of the Continental Divide, ca. 8°48'N, 82°12'W, 700–760 m, 15 Oct 1998 (fl), *Luteyn et al. 15325* (DUKE, MO, NY, PMA, U), *15323* (BM, CAS, DUKE, MEXU, NY, PMA). **Chiriquí:** Fortuna Dam area, Km. 63 N of dam along road to Chiriquí Grande, ca. 8°48'N, 82°12'W, 890 m, 16 Jan 2003 (bud), *Luteyn & Pedraza 15545* (NY, PMA); Campamento de Bijao-Fortuna, 19 Mar 1976, *Mendoza et al. 260* (DUKE); road from Fortuna Lake to Chiriquí Grande, 5 km along track just S of continental divide wet forest, 8°49'N, 82°12'W, 700 m, *Hampshire & Whiteford 441* (NY, PMA).

19. Vaccinium bocatorense Wilbur, Sida 11:441. 1986 [as *bocatorensis*]. TYPE: PANAMA. BOCAS DEL TORO: headwaters of Río Colubre, 2400–2550 m (Colubre Camp), 3 Mar 1984, *Gómez et al. 22368* (HOLOTYPE: DUKE!; ISOTYPE: MO! photo NY neg. 13046).

Epiphytic, scandent *treelets* (fide label); branchlets ± terete, drying brownish. *Leaves* apparently subopposite, the blades persistent, coriaceous, evergreen, ovate to ovate-elliptic, 4–6.5 cm long, 3.5–5 cm broad, apically ± rounded, basally rounded and slightly cordate, marginally entire, glabrous above and moderately but inconspicuously erect-pilosulose beneath with widely spaced, slender, hyaline trichomes 0.2–0.3 mm long, apparently eglandular, the venation 5(–7) plinerved with 2–3 pairs of lateral veins arising within 5–10 mm of the base, the midrib and lateral nerves impressed above and elevated beneath, the reticulate venation not apparent; petioles 2–3 mm long, short-puberulent adaxially, ± glabrous abaxially. *Inflorescences* axillary, congregated distally, sometimes appearing terminal, racemose to subcorymbose, 6–12-flowered, 3–7 cm long overall; rachises ± terete, 2–5 cm long, moderately and inconspicuously pilosulose; floral bracts lanceolate to lance-ovate, acute to acuminate, 3–6 mm long, sparingly puberulent to pilosulose externally; pedicels terete, 10–15(–20) mm long, ca. 1 mm in diam., densely but inconspicuously puberulent with erect hyaline trichomes, striate, eglandular; bracteoles borne along the proximal third of the pedicel, lanceolate to lance-oblong, 4–6 mm long, 0.6–1.5(–1.8) mm broad, adaxially glabrous and abaxially sparingly puberulent to pilosulose and marginally ciliate. *Flowers* 5-merous; calyx 7–10 mm long, ca. 6 mm in diam., articulate

with pedicel, inconspicuously and moderately pilosulose with erect trichomes, the tube broadly cylindric, 3.5–4 mm long, pilosulose and glandular-pustulate throughout, the lobes spreading-recurved or reflexed, narrowly triangular to lanceolate, 4–5 mm long, ca. 2–3 mm broad at base; corolla with aestivation valvate, thick and fleshy, bistratose, urceolate to cylindric-urceolate, constricted at throat, 7–9 mm long, 6–7 mm in diam., externally glabrous, internally glabrous or very nearly so for the basal half and increasingly tangled pilose distally, the lobes broadly deltoid, ca. 2–2.5 mm long, 2.5 mm broad at base, exceedingly densely matted tomentose within; stamens 10, included, ca. 5–6.2 mm long, the filaments very weakly connate basally, ca. 2.5–3 mm long and medially ca. 0.5 mm wide, very much flattened and rather broad, marginally and on both surfaces moderately to densely sericeous especially on the connective abaxially, the anthers ca. 3–4 mm long, lacking spurs, golden, the thecae ca. 2.5 mm long, finely or moderately papillose, strongly incurved basally, the tubules 1–1.5 mm long, about as wide as the thecae, glabrous, dehiscing by introrse, oblique pores; styles included, ca. 7 mm long glabrous. *Berry* not seen.

Distribution.—Known only from the type collection, made along the heavily forested headwaters of the Río Colubre, in the province of Bocas del Toro, Panama, at 2400–2550 m. Flowering: Mar.

Vaccinium bocatorense is characterized by its subopposite leaves with stout, rugose petioles, bullate leaf blades with the apices rounded and the bases rounded to subcordate and often somewhat clasping, plinerved venation with the reticulate veinlets obscure beneath, elongate calyx with proportionately long lobes, thick and fleshy corolla that is urceolate to cylindric-urceolate and conspicuously constricted at the throat, and by stamens with introrse dehiscence and glabrous tubules. The corolla is proportionally small and inconspicuous with respect to the calyx. *Vaccinium bocatorense* keys closest to *V. floccosum* and *V. monteverdense* because of their long calyces and calyx lobes, but its overall relationships within the genus are uncertain.

20. Vaccinium floccosum (L.O. Williams) Wilbur & Luteyn, Brittonia 29:272. 1977. *Hornemannia floccosa* L.O. Williams, Brittonia 18:248. 1966. *Symphysia floccosa* (L.O. Williams) L.O. Williams, Phytologia 24:158. 1972. TYPE: PANAMA. CHIRIQUÍ: Boquete Distr., Bajo Chorro, rainforest, 6000 ft, 11 Jan 1938, *Davidson 104* (HOLOTYPE: F! photo F neg. 52534; ISOTYPES: A! MO! US!).

Terrestrial or epiphytic *shrubs* 1–4 m tall; branchlets slender grayish to olive-brown, glabrous. *Leaves* alternate to subopposite, the blades persistent, coriaceous, evergreen, ovate to lanceolate or elliptic, (3–)5–9(–11) cm long, (1.5–)3–5(–6.5) cm broad, apically acute to acuminate, basally cuneate to rounded, rarely short-attenuate, marginally entire and slightly thickened, glabrous to moderately appressed glandular-fimbriate above and especially beneath, the venation indistincly 3–5(–7)-plinerved and also somewhat arcuately veined; petioles 2–4(–6) mm long, glabrous. *Inflorescences* axillary, loose, umbelliform racemes, mostly 2–4 cm long overall; rachises 2–10(–20) mm long, glabrous to sparingly puberulent; floral bracts persistent, ovate to lance-ovate or lanceolate, 1–3.3 mm long, glabrous to sparingly short-ciliate; pedicels 10–20(–25) mm long, glabrous to sparsely puberulous, but distally often fringed with glandular trichomes 0.1–0.2 mm long; bracteoles approximately medial, subopposite, ovate to lance-ovate, persistent, 1–3.2 mm long, glabrous to inconspicuously ciliate. *Flowers* 5-merous; calyx 4–7.8 mm long, articulate with pedicel, glabrous, the tube campanulate, 2–3 mm long, 3–5 mm in diam., the limb longer than the tube, commonly striate, the lobes broadly triangular, acute, 1.8–3.5 mm long; corolla with aestivation valvate, fleshy, bistratose, broadly cylindric-campanulate, broadest at mouth, 7–10 mm long, 4–5 mm in diam., pale greenish often suffused with red, externally glabrous to moderately appressed spiculate, internally densely floccose with a tangle of white, villous trichomes, the lobes erect to spreading or reflexed, triangular, acute, 2–2.2 mm long, densely villous-floccose within; stamens 10, included, ca. 5.2 mm long, the filaments slightly adherent to the very base of the corolla tube, ca. 3–3.2 mm long, flattened, slightly ciliate, the anthers 3–3.5 mm long, lacking spurs, golden, attached along the lower 1/3, the thecae ca. 2.2–2.5 mm long, papillose, basally incurved and bluntly tapering, the tubules inconspicuous, stout, ca. 1–1.2 mm long, dehiscing by terminal, truncate pores. *Berry* spherical, 8–10 mm in diam., dark purplish at maturity, 5-locular.

Distribution.—Elfin and premontane cloud forests in the high land along the border of the Panamanian Bocas del Toro and Chiriquí provinces, between 1000–2500 m. Flowering: Jan–Oct; fruiting: May–Dec.

Vaccinium floccosum is characterized by its alternate to pseudo-opposite leaves with flat blades, entire margins and plinerved venation, conspicuously striate calyx limbs that are longer than the tubes, greenish corollas that are internally densely floccose apically, and anther tubules that are short, ca. 1 mm long, glabrous, and dehiscene introrsely or by perfectly terminal pores. Leaf morphology is variable with populations from the Boquete region showing leaves coriaceous and inconspicuously petiolate, with blades ovate to ovate-lanceolate, with apices acuminate, and bases rounded or short-attenuate. Populations from the Fortuna Dam area show leaves more thinly coriaceous and more conspicuously petiolate, with blades more lance-elliptic, with apices longer acuminate, and bases tapering and cuneate. All leaf blades with rounded bases are also pseudo-opposite, whereas leaf blades with cuneate leaf bases may be either distinctly alternate or pseudo-opposite. The synonymy of this species as listed above indicates something of the extent of its anomalous characteristics. The relationships of this species are as close to the species centered about *Vaccinium poasanum* as they are to the largely West Indian species usually treated as *Symphysia racemosa* (Vahl) Stearn (= *Hornemannia racemosa* Vahl). The inclusion of all these species within *Vaccinium* does not significantly expand the limits of that extremely diverse genus and still seems to us to be the best treatment for the complex until a worldwide revision of the generic limits is undertaken. Vander Kloet (1985), whose study was largely based upon the West Indian *V. racemosum* (Vahl) Wilbur & Luteyn [= *Hornemannia racemosa* Vahl and *Symphysia racemosa* (Vahl) Stern], argued against such an extension of the generic limits of *Vaccinium* claiming that such an expansion "is tantamount to making the genus a dumping ground for any Vaccinieae of uncertain affinity." In Vander Kloet's experience "the character unique to the genus "Vaccinium" is the absence of calyx tube enlargement prior to anthesis" (see vander Kloet 1985 and vander Kloet et al. 2004 for an alternative opinion).

Additional collections examined: **PANAMA. Bocas del Toro:** along trail on divide separating Chiriquí and Bocas del Toro, ca. 8°45'N, 82°15'W, 22 Oct 1985, *McPherson 7232* (DUKE, MO, NY, TEX). **Chiriquí:** trail to Cerro Pate Macho, headwaters of the Río Palo Alto, above Palo Alto, 8°47'N, 82°22'W, 1700–2100 m, 24 Apr 1982, *Knapp & Schmalzel 4784* (DUKE, MO); Boquete Distr., Bajo Mono and Bajo Chorro trails out of Boquete, 1 Jun 1972, *Luteyn 3069* (DUKE, MO, NY); premontane cloud forest along ridge E of Cerro Horqueta, 1700–1900 m, 4 Jan 1975, *Luteyn & Wilbur 4600* (DUKE, MO, NY); slopes approaching Cerro Horqueta, ca. 6.6 km NNE of Boquete, 1500–1800 m, 5 Jan 1975, *Wilbur & Luteyn 19330* (DUKE, F, GH, LL, MICH, MO, NY, PMA, US).

21. Vaccinium monteverdense Wilbur & Luteyn, Brittonia 53:442. 2001. TYPE: COSTA RICA. GUANACASTE: Monteverde area, Hacienda Ira Rosa, 3.7 km above Santa Elena and ca. 1 km before Río Negro just before the Sky Walk, ca. 1500 m, 10 Mar 1999 (fl), *Luteyn et al. 15408* (HOLOTYPE: NY!; ISOTYPE: CR!).

Epiphytic or terrestrial *shrubs*, 1–2 m tall, arising from lignotubers; branchlets ± terete, reddish-brown, glabrous, those of the preceeding year's growth grayish with the bark exfoliating and splitting longitudinally. *Leaf-blades* persistent, coriaceous, evergreen, ovate-lanceolate to elliptic, (2.4–)3.4–8 cm long, (0.8–)1.2–2(–2.7) cm broad, apically somewhat abruptly acuminate to short-acuminate, the tip itself ± bluntly obtuse and ca. 2 mm wide, basally rounded to obtuse, usually short-acuminate and narrowly decurrent onto petioles, marginally entire and revolute causing leaves to be concave, weakly bullate, glabrous on both surfaces, the venation 3(–5)-plinerved with usually only midrib prominent; petioles somewhat angulate and strongly canaliculate, 4–8 mm long, ca. 1.5 mm in diam., glabrous or very nearly so. *Inflorescences* terminal, racemose, 7–9(–16)-flowered; rachises ± terete ca. 2–3(–4.7) cm long, glabrous, reddish; floral bracts inconspicuous, appressed, scale-like, ovate, ca. 0.8–1.5 mm long; pedicels terete, 14–19 mm long, ca. l–1.2 mm in diam., glabrous, dull reddish; bracteoles nearly basal, subopposite, scale-like, appressed, elliptic to narrowly triangular, ca. 0.6–0.8 mm long. *Flowers* 5-merous; calyx 10–16 mm long, articulate with pedicel, glabrous, green flushed with red, the tube cylindric to obconic, 4.5–8.5 mm long, 2–3 mm in diam. basally and 4–6 mm in diam. proximally and ca. 1 cm in diam. distally, striate to slightly ribbed when dry, the limb spreading to campanulate, 5.5–7.5 mm long, conspicuously striate, the lobes deltoid, 2.5–3.5 mm long, 4–5 mm broad basally; corolla with aestivation valvate, thinly fleshy, bistratose, broadly cylindrical to campanulate, 13–18 mm long, 9–15 mm in diam. distally, green suffused with maroon to reddish-maroon or purplish, glabrous, the lobes ca. 3–3.5 mm long, 3–4 mm broad at base; stamens 10, included, ca. 11.5–12 mm long, the filaments distinct, ca. 4.7–5 mm long, flattened, marginally long-pilose, the anthers ca. 8–8.4 mm long,

lacking spurs, golden, the thecae ca. 3.2–3.4 mm long, papillose, bluntly apiculate basally, the tubules ca. 4.8–5 mm long, distinct, long-pilose along inner surfaces, dehiscing by short, slightly latrorse clefts ca. 1.4–1.5 mm long; styles slender, 12–15 mm long, glabrous. Mature *berry* unknown, but at least 8 mm in diam. and spherical when immature.

Distribution.—Known only from a few collections in cloud forest, from the Costa Rican Cordillera de Tilarán in the vicinity of Monteverde, where the provinces of Alajuela, Guanacaste, and Puntarenas join one another, and also from the Province of Guanacaste in the Cordillera de Guanacaste on the lower slopes of Cerro La Gigante, at ca. 1400–1600 m. Flowering: Jan–Mar.

Vaccinium monteverdense is characterized by having leaf blades with two circular, concave, blackish glands ca. 0.2 mm diam., one on either side of midrib on lower surface, conspicuously striate calyx limb, cylindric-campanulate corolla that is mostly green but suffused with maroon or reddish-maroon apically, stamens that are adherent to the base of the corolla, relatively long filaments, and anthers with pilose tubules that dehisce latrorsely. Furthermore, its leaves are often slightly bullate and concave. The relationships of *V. monteverdense* are uncertain at this time.

Additional collections examined: **COSTA RICA. Guanacaste-Puntarenas-Alajuela:** Cordillera de Tilarán; Monteverde, ca. 1 m S of the Cloud Forest Reserve Field Station, ca. 1460 m, 23 Feb 1986, *Almeda et al. 5082* (CAS). **Guanacaste:** Cordillera de Guanacaste, lower slopes of Cerro La Giganta ca. 2 km W of Río Naranjo, 2600 ft, 27 Feb 1975, *Utley 1885* (DUKE, NY). **Puntarenas:** cloud forest above the Quaker settlement at Monteverde, 1600–1700 m, 4 May 1975, *Utley 2376* (DUKE).

22. Vaccinium campanense Wilbur & Luteyn, sp. nov. (**Fig. 2**). TYPE: PANAMA. PANAMÁ: Dist. de Capira, Cerro Campana, trocha desde el mirador a la cima, 800 m, 8°41'N, 79°55'W, bosque nebuloso, *Galdames et al. 1840* (HOLOTYPE: PMA!; ISOTYPES: CAS!, DUKE!, MO!, NY!, SCZ!, US!).

Frutex epiphyticus. Petioli 3–4 mm longi, pilosuli et puberuli. Folia coriacea, integra, ovata vel ovato-elliptica, 2–4.7 × 1.2–2.4 cm, 3–5 plinervia, venatio reticulata, brochidroma. Inflorescentia umbellate-racemosa, 1–2.5 cm longa; rhachis 4–8 mm longa, glandulo-strigillosa et pilosula; pediceli 7–15 mm longi; bracteae caducae. Calyx pedicellis articulatus; tubo cylindrico, 2–3.5 mm longo et 2–3 mm diam., striato, lobato, glandulato; lobi calycis 5, detoidi, 4–5 × 2–2.7 mm, acuti; corolla campanulata, verde, ca. 7–15 × 9–10 mm, lobi corollae triangulari, acuti, ca. 3 × 3.5 mm, stamina 10, thecae granulosae, ± 3–3.6 mm longae.

Epiphytic *shrubs* to 2 m tall; branchlets ± terete, brownish, grayish or blackish, the youngest 1.5–3 mm in diam., finely ridged, inconspicuously puberulous. *Leaf-blades* persistent, coriaceous, evergreen, ovate to ovate-elliptic, 2–4.7 cm long, 1.2–2.4 cm broad, apically usually tapering into a 4–8 mm long, blunt, tongue-like tip, basally usually rounded, marginally entire, the venation 3–5-plinerved, the midrib and secondary veins somewhat sunken above and elevated beneath, the upper surface glabrous at maturity but initially moderately beset with dark reddish, glandular-appressed trichomes that rarely persist into maturity and the sunken veins proximally usually somewhat puberulous, the lower surface moderately beset with minute, often appressed puberulence on the surface and principal veins and those on the surface apparently glandular and darkening reddish-brown upon drying and perhaps 0.1 mm long, usually disappearing with age; petioles terete or nearly so 3–4 mm long, minutely puberulous. *Inflorescences* axillary, racemose, 1–3-flowered, ca. 1–2.5 cm long overall; rachises mostly 4–8 mm long or less, sparingly puberulous to short-pilose; floral bracts 1–1.2 mm long; pedicels 7–15 mm long, sparingly puberulous to short-pilose, drying reddish-brown; bracteoles basal, linear, 1–2(–3) mm long, glandularly minutely ciliate. *Flowers* 5-merous; calyx ca. 8–8.5 mm long, clearly articulate with pedicel, the tube cylindric, 5(–10)-ribbed when fresh, 2–3.5 mm long, 2–3 mm in diam., striate, moderately minutely glandularly appressed pubescent, the limb ca. 5.5 mm long, the lobes triangular, strikingly acute, 4–5 mm long, 2–2.7 mm broad, striate, green, minutely reddish-glandular puberulent; sinuses acute; corolla with aestivation valvate, thinly fleshy, bistratose, broadly campanulate, ca. 7–15 mm long, 9–10 mm in diam., green, the lobes triangular, acute, ca. 3 mm long and 3.5 mm broad at base; stamens 10, included, 9.5–9.6 mm long, the filaments distinct, ca. 3–3.6 mm long and 1.5 mm wide at base, slender but broadening basally, marginally long-ciliate, dorsifixed, the anthers ca. 7.5–8 mm long, lacking spurs, orangish-yellow, the thecae 3–3.6 mm long and 1–1.5 mm wide, finely papillose, the tubules somewhat divergent, each ca. 3–4.6 mm long and 0.5 mm wide, dehiscing by latrorse clefts ca. 1.5–2.5 mm long and 0.5 mm wide; styles slightly exserted. Mature *berry* unknown.

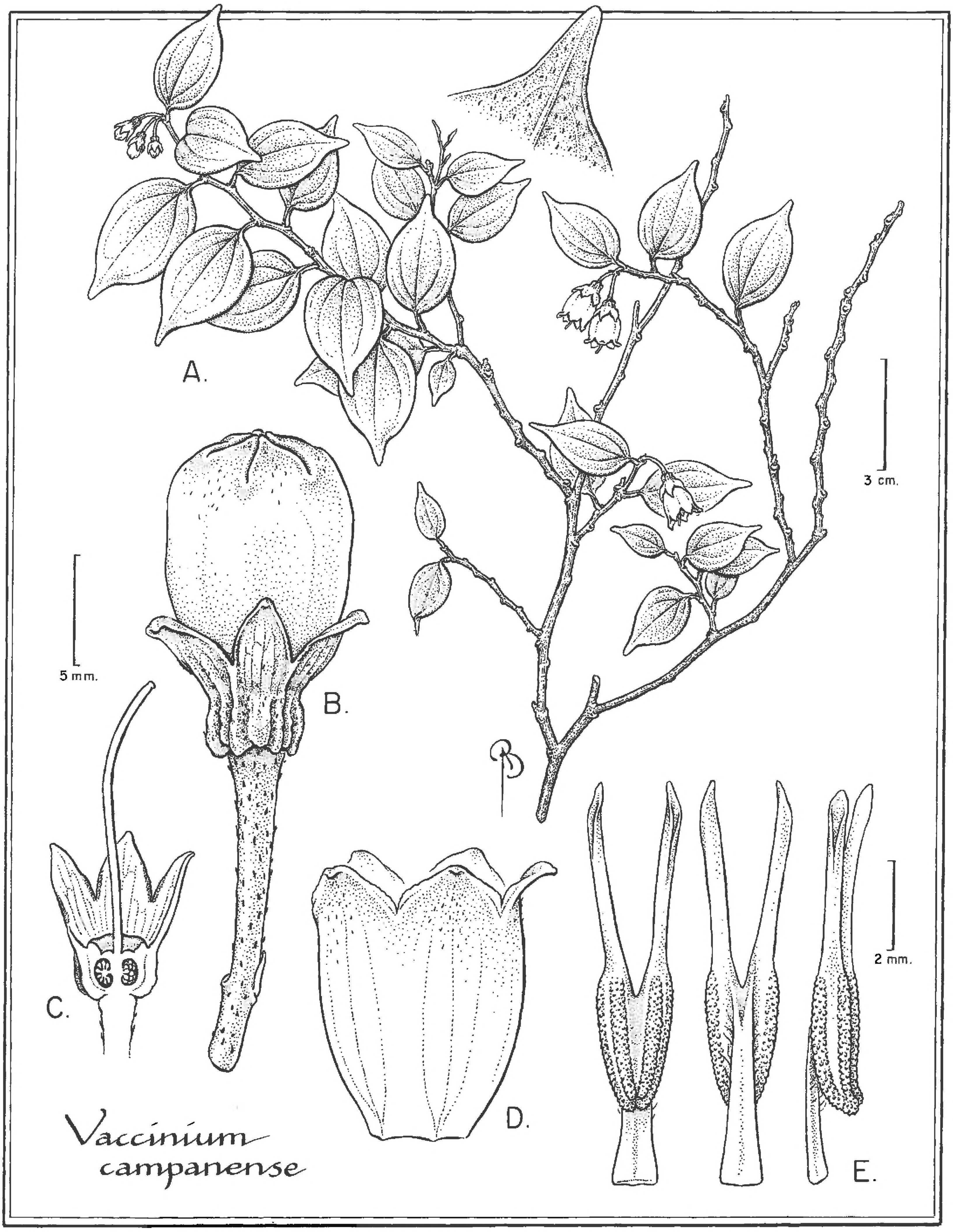


FIG. 2. *Vaccinium campanense* Wilbur & Luteyn. **A**, habit with inset of leaf undersurface showing glandular appressed trichomes and tip. **B**, flower in bud showing valvate aestivation of corolla, calyx tube ribs, and glandular-fimbriate pedicels. **C**, calyx, longitudinal section. **D**, mature corolla. **E**, stamens showing ventral, dorsal, and side views with latrorse dehiscence clefts (drawn from type collection).

Distribution.—Epiphyte in the canopy of cloud forest trees. This very distinctive species has apparently only been collected twice, which is surprising as Cerro Campana is a frequently visited and botanized area relatively close to Panama City, at ca. 800–850 m. Flowering: Feb.

Vaccinium campanense is one of the green-flowered species of *Vaccinium* that is additionally distinguished by its combination of small, entire-margined leaves, few-flowered inflorescences, calyces densely glandular-fimbriate with 5–10 bluntly ribbed tubes and prominently striate, proportionately long and strikingly acute calyx lobes, and broadly campanulate corolla.

Additional collection studied: Cerro Campana, topotype, 13 Feb 1996, *Luteyn & Galdames 14857* (NY) (flowers from forest floor only).

23. Vaccinium poasanum J.D. Smith, Bot. Gaz. (Crawfordsville) 24:395. 1897. *Symphysia poasana* (J.D. Smith) vander Kloet, Taxon 53:97. 2004. LECTOTYPE COSTA RICA. ALAJUELA: Volcán Poas, 2600 m, Mar 1896, *J. Donnell Smith 6634* (LECTOTYPE GH! ISOLECTOTYPE: K! SYNTYPE US! photo NY neg. s.n.).

Terrestrial or epiphytic *shrubs* or small *trees* (1–)2–5(–7) m tall; branchlets glabrous. *Leaf-blades* persistent, coriaceous, evergreen, ovate to lanceolate or elliptic, 3–8(–10) cm long, (1–)2.5–4(–6) cm wide, apically acute to acuminate, basally acute, broadly cuneate or acuminate (very rarely auriculate), marginally entire and slightly revolute, glabrous or sparingly to moderately appressed glandular-fimbriate above and especially beneath, rarely short-puberulent near the base, the venation indistinctly 3–5-plinerved and also somewhat arcuately veined; petioles 1–4 mm long, glabrous to hirsutulous. *Inflorescences* axillary, umbelliform racemes, mostly 2–4 cm long overall, (4–)7–13-flowered; rachises 0.5–2 cm long, glabrous to sparingly puberulent; floral bracts persistent, lance-ovate to lanceolate, 1.5–2.5 mm long, ciliate; pedicels slender, 7–15 mm long, sparingly puberulent, often distally with a fringe of glandular trichomes 0.1–0.2 mm long; bracteoles submedial, subopposite, lance-ovate to lanceolate, often persistent, 1–1.5 mm long, ciliate. *Flowers* 5-merous; calyx 3.5–5 mm long, clearly articulate with pedicel, glabrous to densely puberulent, the tube short-campanulate to turbinate, 2–3.5 mm long, about equal in diam., the limb 1–2 mm long, the lobes broadly and shallowly deltoid, apiculate, 0.2–1 mm long; corolla with aestivation valvate, thinly fleshy, bistratose, broadly cylindric, 8–12 mm long, 6–10 mm in diam., pale yellowish or greenish-white and occasionally tinged with bright rose or pink, externally and internally glabrous or rarely apically sparsely villose, the lobes erect to slightly recurved, broadly oblong, apically acute to obtuse, 2–3.5 mm long; stamens 10, included, 7.5–8.5 mm long, the filaments 2–2.5 mm long, ciliate, flattened, broadened basally where slightly adherent to the very base of the corolla, the anthers 6–7 mm long, lacking spurs, golden, attached slightly above the middle, the thecae 1.8–2.2 mm long, papillose, basally incurved, the tubules 3.5–5.5 mm long, glabrous, dehiscing by slightly introrse, oblique pores but appearing ± terminal; styles exserted, 8–10 mm long. *Berry* subspherical, 7–10 mm in diam., dark purple at maturity, 5-locular.

Distribution.—Montane forests and thickets from Guatemala south into central Panama, from 900–3300 m. Flowering: throughout most of year especially from Dec–Mar and Jul–Sep; fruiting: throughout much of the year.

Vaccinium poasanum is characterized by its leaves with acute to broadly cuneate blade bases and acute to acuminate apices, apiculate calyx lobes, broadly cylindric corollas, staminal filaments that are conspicuously shorter than the overall anthers, and elongate anther tubules. Like many other of the green-flowered species of *Vaccinium*, the inter-specific relationships of *V. poasanum* are uncertain. It is, however, morphologically similar to *V. campanense*.

Additional collections examined: **GUATEMALA. Baja Verapaz:** in high forest on hill, Unión Barrios, 13 Mar 1972, *Contreras 11293* (DUKE, LL). **Zacapa:** upper reaches of Río Sitio Nuevo, 1500–1800 m, 25 Jan 1942, *Steyermark 43200* (A, F, NY, US). **HONDURAS. Comayagua:** in cloud forest, 2300 m, Montaña Comayagua, 6 Mar 1975, *Hazlett 2499* (MO). **El Paraiso:** dense cloud forest, Mt. Volcán, 1950 m, 16 Mar 1947, *Williams & Molina R. 12183* (F, GH, US). **Morazán:** along road to Parque Nacional La Tigra, 22–25 km NE of Tegucigalpa; cloud forest, 14°12'N, 87°07'W, 1850–2125 m, 1 Feb 1987, *Croat & Hannon 64045* (DUKE, MO, NY); in rainforest, Mt Uyca, 2000 m, 20 Aug 1964, *Williams & Molina R. 10380* (DS, F, LL, MICH, MO, PH); windswept ridge in cloud forest area, Montaña La Tigra, San Juancito Mts. ca. 15 km NE of Tegucigalpa, 2000–2200 m, *Williams et al. 23273* (CAS, DS, F, LL, MICH, NY, US). **Santa Bárbara:** upper rocky slopes and summit of Cerro Santa Bárbara, 2750 m, 5–6 Apr 1951, *Allen et al 6066* (DS, F, US). **EL SALVADOR.**

Santa Ana: Cerro Montecristo, 6000–6500 ft, 17 Jan 1959, *Allen 7153* (DS, F, LL, NY, US); moist cloud forest, Cordillera Miramundo, Mt. Montecristo, 2000–2200 m, 27–3l Jan 1966, *Molina R. et al. 16711 & 16825* (F, NY, US). **NICARAGUA. Matagalpa:** cut-over cloud forest area, El Porvenir, Cordillera Central, 1700 m, 11 Mar 1967, *Molina R. 20515* (F, NY, US). **Zelaya:** cloud forest and lower elfin forest, Cerro La Pimienta, northern slope facing La Garrapata, ca. 13°45'N, 84°59'W, 900–1180 m, 16 Mar 1980, *Pipoly 6040* (DUKE, MO, NY). **COSTA RICA. Alajuela:** open wooded slopes ca. 1 km from lip of crater and 19 km W of Vara Blanca, Volcán Poas, 2700 m, 21 Jan 1968, *Wilbur & Stone 9843* (DS, DUKE, F, LL, MICH, MO, MSC, NY, US). **Heredia:** Volcán Barba, 8.3 km beyond fork in road at Porrosati, 2600–2800 m, 16 Mar 1975, *Utley 1959* (CR, DUKE, F, MO, NY, US). **Cartago:** SE slope of Volcán Irazú on farm road between CR #8 and Finca Coliblanco, 1–2 km S of Esperanza, 3000–2600 m, 28 Jan 1976, *Utley 3813* (CR, DUKE, F, MICH, MO, NY, US); on lower slopes of Volcán Turrialba, 1–2 km S of Finca Central, 2600–2700 m, 15 Mar 1976, *Utley 4293* (DUKE, MO, NY). **Cartago-San José:** bog and surrounding wooded hills ca. 11 mi SE of El Empalme along Pan American Hwy, ca. 9000 ft, 2 Feb 1970, *Wilbur & Teeri 13901* (DUKE, F). **San José:** Cordillera Central along CR 220 between Alto La Palma and Bajo La Hondura, ca. 4200–3800 ft, 4 Jul 1972, *Luteyn 3315* (DUKE, F, MO, NY); Cerros de Escazu (Cedral), approach to and summit of Cerro Danser ca.. 3–5 km SW of Aserrí, 2300–2400 m, 13 Mar 1976, *Utley 4291* (CR, DUKE, F, MICH, MO, NY, US). **Puntarenas:** Reserva Monteverde, Cerro Negro, 1500–1600 m, *Haber & Bello C. 2814* (DUKE, MO). **Limón:** Cordillera de Talamanca, Atlantic slope, Valle de Silencio along Río Terbi, 0.5–1.5 airline km W of Costa Rican-Panamanian border, 2300–2400 m, 9°08'N, 82°57'W, 9 Sep 1984, *Davidse et al. 28717* (DUKE, MO). **PANAMA. Bocas del Toro:** upper Río Colubre, 2500–3000 m, Aug 1983, *Gómez et al. 21923* (DUKE, MO, NY). **Chiriquí:** mossy forest ca. 7000 ft, E of Guadeloupe along the Río Chiriquí Viejo ca. 2 mi NE of Cerro Punta, ridge of Cerro Respinga, 13 Jan 1971, *Wilbur & Foster 13114* (DAV, DS, DUKE, F, LL, MICH, MO, NY, PMA). **Coclé:** sawmill N of El Cope along divide, 25 Feb 1979, *Hammel 6267* (MO).

24. Vaccinium almedae Wilbur & Luteyn, Sida 21:1607, fig. 1. 2005. TYPE: PANAMA. CHIRIQUÍ: Edwin Fabrega Dam and Reserve in Fortuna, along trail to hydrological station, along Río Hornito, below forestry house along the road in wet forest, 8°45'N, 82°5'W, 1200 m, 20 Jan 1989, *Almeda et al. 6369* (HOLOTYPE: PMA!; ISOTYPES: CAS! DUKE! NY!).

Coarse, rigid, epiphytic *shrubs* 1–2 m tall; branchlets and branches ± terete, glabrous or nearly so but current season growth not present, thin, brownish or grayish. *Leaf-blades* persistent, coriaceous, evergreen, elliptic, mostly 6–18 cm long, 3–7.5(–9) cm broad, apically acute to acuminate, basally rounded to shortly tapering and sometimes curling or somewhat conduplicate around the petiole at the junction, marginally entire, glabrous on both surfaces, the venation 3–5-plinerved, the veins ± depressed above except the midrib elevated for the proximal third to half while elevated beneath through the 3–4 order and forming an indistinct reticulum; petioles somewhat flattened above and there rather broadly and shallowly canaliculate, mostly 7–15 mm long, 2–3.5 mm in diam., glabrous. *Inflorescenses* mostly ramiflorous, of several to numerous, sessile fascicles (2–10-flowered) emerging from small, depressed mounds 1–2 mm in diam. and 1–2 mm long; floral bracts scale-like, 0.6–1.5 mm long, ciliate; pedicels slender, 5–10 mm long, 0.2–0.3 mm in diam., glabrous; bracteoles deltate, 0.5–0.8 mm long, ciliate. *Flowers* 5-merous; calyx ca. 3–4 mm long, clearly articulate with pedicel, the tube cylindric-obconic, ca. 1.5–2.2 mm long, 1.6–2 mm in diam., glabrous, the lobes broadly based, minute, varying from barely detectable to perhaps as much as 0.2–0.4 mm long, glabrous; corolla with aestivation apparently valvate, membranaceous, thinly bistratose, cylindric to more typically gradually funnelform, 5–9 mm long, flaring to ca. 5–6 mm in diam. from a 2–2.5 mm diam. base, greenish-white, glabrous both externally and internally, the lobes narrowly triangular to deltoid, acute, ca. 2.5 mm long; stamens 10, included, 7–8 mm long, the filaments 1–2.5 mm long, united in the basal 0.5 mm, glabrous, flattened, the anthers 6–7 mm long, lacking spurs, attached medially, the thecae ca. 1.4–2.2 mm long, finely papillose, basally incurved and apiculate, the tubules ca. 3–4.8 mm long, dehiscing by truncate to slightly flaring, terminal pores; styles slightly exserted, glabrous. Mature *berry* unknown, but when immature at least 3–4 mm in diam., glabrous.

Distribution.—Known only from four collections made in wet forest, near the Fabrega Dam site at Fortuna (Chiriquí Prov.) and Cerro Colorado (Bocas del Toro Prov.), Panama, at 1150–1500 m. Flowering: Jan.; immature fruits: Apr.

Vaccinium almedae is characterized by its short-racemose to fasciculate inflorescences that are sometimes ramiflorous, rotate to flaring calyx limb, minute calyx lobes, pale green to white corolla, staminal filaments that are conspicuously shorter than the anthers, and anther tubules that are conspicuously longer than the thecae and that dehisce by truncate to slightly flaring, terminal pores. Its relationships are unclear at this time.

Additional collections examined: **PANAMA. Bocas del Toro:** region of Cerro Colorado 7 mi from Chami Camp, ca. 8°35'N, 81°45'W, ca. 1500 m, 12 Apr 1986, *McPherson 8825* (MO). **Chiriquí:** Fortuna Dam region, along trail to hydrological station on Río Hornito, below forestry house on hwy, 8°45'N, 82°15'W, 1150–1200 m, 20 Jan 1989, *McPherson 13612* (DUKE, MO); Fortuna dam site, along stream on white sandy soil, 1200 m, 7 Feb 1985, *van der Werff & van Hardeveld 6609* (MO, photo NY neg. 13043).

25. Vaccinium santafeense Wilbur & Luteyn, Ann. Miss. Bot. Gard. 65:140. 1978. *Symphysia perardua* vander Kloet, Taxon 53:97. 2004. TYPE: PANAMA. VERAGUAS: NW of Santa Fé, 2 km from Escuela Agrícola Alto de Piedra, ridge top cloud forest below summit of Cerro Tute, 27 Mar 1975, *Mori & Kallunki 5248* (HOLOTYPE: MO!).

Epiphytic *shrubs* 1–2(–3) m tall, vegetatively glabrous throughout; branchlets and twigs terete, gray to light brown when dry. *Leaf -blades* persistent, drying subcoriaceous, evergreen, elliptic, 5–8 cm long, 2–3 cm broad, apically acute to acuminate or even tapering into a pronounced drip-tip 8–12 mm long, basally cuneate, marginally entire, the venation pinnate, the midrib elevated proximally above while sunken distally and beneath elevated throughout; petioles dorsiventrally compressed, 6–11 mm long, 1.5–2 mm broad. *Inflorescences* racemose to subcorymbose, 2–8-flowered; rachises terete, smooth or weakly striate, 5–9 mm long; floral bracts ovate to oblong-ovate, acute, keeled, 1–1.2 mm long, appressed, irregularly and minutely marginally denticulate; pedicels terete, smooth to weakly striate, 8–12 mm long, distally minutely fimbriate; bracteoles basal, slightly smaller and more closely appressed, ca. 1 mm long, minutely denticulate. *Flowers* 5-merous; calyx ca. 3.5 mm long, markedly articulate with pedicel, the tube terete, ca. 2 mm long, 2.5 mm in diam., the lobes broadly triangular with shallowly indented to almost flat sinuses, ca. 0.6 mm long; corolla with aestivation valvate, thin-carnose, bistratose, cylindric, 8–9 mm long, abruptly contracted for the lower 1.5–2 mm and there 2.2–2.5 mm in diam., 4–4.2 mm in diam. above, greenish-white, glabrous both internally and externally, the lobes erect to somewhat recurved, triangular, acute, 2–2.5 mm long; stamens 10, included, 6–7.7 mm long, the filaments distinct, 2–3.2 mm long, ca. 0.5 mm wide, flattened, ciliate, the anthers ca. 5.5 mm long, lacking spurs, the thecae 2–2.5 mm long, finely to coarsely papillose, the tubules 3–3.6 mm long, glabrous, dehiscing by elongate, latrorse clefts 2–3 mm long; styles slightly exserted, 9–10 mm long. Mature *berry* unknown.

Distribution.—Known only from five collections in cloud forest, on or near Cerro Tute ca. 10 km NW of Santa Fé, Veraguas, Panama, at 900–1000 m. Flowering and fruiting: Jan–May.

Additional collections examined: **PANAMA. Veraguas:** NW of Santa Fé, 2 km from Escuela Agrícola Alto Piedra, ridge top cloud forest below summit of Cerro Tute, 27 Mar 1975, *Mori & Kallunki 5249* (MO, photo NY neg. 13044), 28 Mar 1975, *Mori & Kallunki 5280* (MO); Cerro Tute, ca. 10 km NW of Santa Fé, on ridge top in cloud forest, ca. 1000 m, 19 May 1975, *Mori 6254* (MO); along steep trail to summit of Cerro Tute, ca. 3 km above Escuela Agrícola Alto Piedra, near Santa Fé, 2800–3000 ft, 4 Jan 1981, *Sytsma & Antonio 3029* (NY).

26. Vaccinium costaricense Wilbur & Luteyn, Brittonia 29:270, fig. 5. 1977. *Symphysia costaricensis* (Wilbur & Luteyn) vander Kloet, Taxon 53:97. 2004. TYPE: COSTA RICA. HEREDIA: vicinity of Cerro Chompipe, 21 Dec 1974, *Wilbur & Luteyn 18579* (HOLOTYPE: DUKE!; ISOTYPES: CR! F! MO! NY!).

Terrestrial or more typically epiphytic *shrubs*, 1–3(–4) m tall; branchlets grayish to reddish-brown, glabrous. *Leaf-blades* persistent, coriaceous, evergreen, ovate or lanceolate to elliptic, (2.5–)4–8(–11) cm long, (1.5–)2.5–4.5(–6.2) cm broad, apically acute to acuminate, basally acutely tapering to rounded, marginally entire and slightly thickened, appearing slightly revolute, glabrous to moderately but inconspicuously appressed glandular-strigillose both above and more especially beneath, the venation 3–5(–7)-plinerved and also somewhat weakly arcuately veined; petioles 1–2 mm long, glabrous. *Inflorescences* axillary but often superficially appearing terminal, of umbelliform racemes, 10–15-flowered; rachises 1–2.5(–3) cm long, glabrous to very sparingly and minutely puberulent; floral bracts persistent, ovate-lanceolate to lanceolate or triangular, scale-like, 1–3.5 mm long, glabrous to minutely ciliate; pedicels mostly 10–30 mm long, glabrous to inconspicuously puberulous or often indistinctly distally fringed with glandular trichomes ca. 0.1 mm long; bracteoles usually in the lower third, ± subopposite, lance-ovate to lanceolate, persistent, 0.8–3 mm long, appressed, glabrous to indistinctly ciliate. *Flowers* 5-merous; calyx 3.5–5(–5.8) mm long, clearly articulate with pedicel, glabrous to densely, minutely puberulent, the tube campanulate, ca. 2–2.5(–4) mm long, 2.5–3 mm in diam., the lobes triangular, acute, 1.2–1.8(–2) mm long; corolla with aestivation valvate, fleshy,

bistratose, broadly cylindric to somewhat urceolate, 5–8 mm long, 4–7 mm in diam., pale greenish-yellow, externally glabrous and internally moderately to densely pilose with sordid, white trichomes especially in the throat and on the lobes, the lobes erect to spreading or somewhat reflexed, triangular, acute, 1–2 mm long; stamens 10, included, ca. 6 mm long, the filaments 3–4 mm long, flattened, slightly adherent to the very base of the corolla tube, slightly ciliate, the anthers ca. 3–4 mm long, lacking spurs, golden, attached in the lower quarter, the thecae ca. 1.8–2 mm long, papillose, basally incurved and apiculate, the tubules stout, ca. 1–2 mm long, dehiscing by introrse, slightly oblique or slightly flaring, terminal pores. *Berry* spherical, 11–16 mm diam., dark maroon to blackish-maroon, or purple, 5-locular.

Distribution.—Mountain slopes covered by premontane rainforests, on Atlantic slope of Costa Rica (Heredia and San José) and Continental Divide forests in Panama (Bocas del Toro and Chiriquí), between (700–)1100–2000 m. Flowering and fruiting: throughout much of the year.

Vaccinium costaricense is characterized by its combination of acutely tapering to rounded leaf blade bases, a calyx tube that is longer than the limb, corollas that are pilose internally at the throat, and short anther tubules. *Vaccinium costaricense* has a longer rachis, shorter calyx limb and lobes, smooth, not striate, calyx limb and lobes, and longer anther tubules than its morphologically closest relative *V. floccosum*, from western Chiriquí Prov., Panama. These differences in the calyx may be influenced by where and how the plants grow, i.e., epiphytes in the closed forest vs. terrestrial in exposed, windswept areas (JLL, pers. observ.). *Vaccinium costaricense* differs from *V. orosiense* by acutely tapering to rounded leaf blade bases (not cordate and amplexicaul) and shorter calyx lobes (at least in the Costa Rican populations). The characters that distinguish these three species of *Vaccinium* are admittedly few and more collections are needed to help clarify their morphologies and relationships.

Additional collections examined: **COSTA RICA. Heredia:** forest between Río Pejé and Río Sardinalito, Atlantic slope of Volcán Barva, 10°17.5'N, 84°04.5'W, 700–800 m, 3 Apr 1986, *Grayum 6706* (DUKE); primary forest near Río Las Vueltas, NE of Volcán Barba, 1950 m, 25 Jun 1972, *Lent 2645* (DUKE, NY, PMA); forests between Río Las Vueltas and Quebrada Cabrú, vicinity of Cerro Chompipe, 1700–2000 m, 21 Dec 1974, *Luteyn & Wilbur 4438* (DUKE, F, MO, NY); vicinity of Cerro Chompipe between Río Las Vueltas and Río Nuevo, 1800–2000 m, ca. 12 km NNE of San Rafael, 21 Dec 1974, *Wilbur & Luteyn 18576* (DUKE, F, MICH, MO, NY, US). **San José:** CR 216, ca. 3–6 km beyond Las Nubes in vicinity of Cascajal on NW flank of Volcán Irazú, 5700 ft, 10 Dec 1975, *Almeda et al. 2626* (CAS, DUKE); pastured slopes and thicket at Alto La Palma ca. 15 km in straight line NE of San José, 1480 m, 13 Jul 1976, *Wilbur 20339* (CR, DUKE, F, LL, MICH, MO, NY, PMA, US, WIS). **PANAMA. Bocas del Toro:** along road between Fortuna and Chiriquí Grande, 1.2 mi N of Continental Divide, 5.3 mi N of bridge over Fortuna Dam, 8°44'N, 82°17'W, 910 m, 12 Mar 1985, *Croat & Grayum 60459* (DUKE, NY). **Chiriquí:** east of the Fortuna main campsite, 1200–1600 m, 12 Sep 1977, *Folsom & Dressler 5300* (DUKE, MO); windswept ridge 10 km N of Los Planes de Hornito, IRHE Hydroelectric Project, 1150 m, 18 Jun 1982, *Knapp & Vodicka 5603* (DUKE, MO); forested slope along ridge, vicinity of Fortuna Dam, ca. 8°45'N, 82°15'W, ca. 1250 m, 28 Apr 1986, *McPherson 9094* (DUKE, MO, NY).

27. Vaccinium orosiense Wilbur & Luteyn, Brittonia 29:275. 1977. *Symphysia orosiensis* (Wilbur & Luteyn) vander Kloet, Taxon 53:97. 2004. TYPE: COSTA RICA. CARTAGO: steep slopes above the Río Grande de Orosi, on property of ICE Hydroelectric plant ca. 15–20 km upstream from the suspension bridge, 1300–1800 m, 20 Dec 1974, *Luteyn et al. 4411* (HOLOTYPE: DUKE!; ISOTYPES: CR! F! MO! NY! US!).

Epiphytic or terrestrial *shrubs*, 1–2 m tall; branchlets glabrous, olivaceous to purplish. *Leaves appearing subopposite, the blades* persistent, coriaceous, evergreen, ovate to ovate-lanceolate, (2–)4–9(–14) cm long, (1.5–)3–5(–7) cm broad, apically acute, basally rounded to more typically cordate, clasping to amplexicaul, marginally entire and slightly thickened, glabrous to sparsely and inconspicuously appressed, glandular-strigillose, the venation indistinctly 5–7(–9)-plinerved; petioles ca. 1 mm long, glabrous. *Inflorescences* axillary but often superficially appearing terminal, of umbelliform racemes mostly 2–4 cm long overall; rachises mostly 1–1.5 cm long, glabrous; floral bracts persistent, triangular to ovate-lanceolate, scale-like, 1–2.2 mm long, glabrous to minutely ciliate; pedicels mostly 15–25 mm long, glabrous; bracteoles usually in the lower quarter, subopposite, deltoid to lance-ovate, persistent, 0.8–1.5 mm long, appressed, glabrous to inconspicuously ciliate. *Flowers* 5-merous; calyx 2–4 mm long, clearly articulate with pedicel, glabrous, the tube campanulate to urceolate, ca. 2–3 mm long, 2.5–4 mm in diam., the lobes triangular, acute, 0.5–1.2 mm long, glabrous; corolla with aestivation valvate, fleshy, bistratose, cylindric to urceolate, 5–8 mm long, 5–7 mm in diam., yellowish-green often suffused with maroon, externally glabrous and internally moder-

ately to densely pilose with white trichomes especially on the lobes and the upper half of the tube, the lobes spreading or reflexed, triangular, acute, 1–1.2 mm long; stamens 10, included, ca. 6 mm long, the filaments ca. 3 mm long, flattened, weakly adherent to the very base of the corolla tube, villous, the anthers ca. 4 mm long, lacking spurs, golden, attached medially, the thecae ca. 1.5–2.3 mm long, papillose, basally incurved and apiculate, the tubules stout, ca. 1.5–2 mm long and 0.5 mm wide, dehiscing by slightly introrse, oblique pores. *Berry* spherical, ca. 12 mm diam., "morada," 5-locular.

Distribution.—Known only from the heavily forested slopes above the Río Grande de Orosi near Tapantí (Cartago), Costa Rica, and from the Fortuna area, Panama (Chiriquí), at 1130–1800 m. Flowering and fruiting: apparently extends through much of the year.

Vaccinium orosiense is characterized by its amplexicaul leaves with rounded or cordate blade bases, short calyx lobes, corollas that are moderately to densely pilose internally at the throat, and by short anther tubules. When fresh, the basal region of the leaf blades is red, as is also the case in *V. costaricense, V. floccosum*, and *V. luteynii*, but usually not in *V. poasanum*. The relationships of *V. orosiense* are mentioned under the discussion of *V. costaricense*.

Additional collections examined: **COSTA RICA. Cartago:** Hwy 224 on property of ICE Hydroelectric Plant, ca. 11.6–20 km E of the church in Orosi, steep roadside banks, 1500–1700 m, 29 Dec 1973, *Almeda et al. 2180* (DUKE, F, GH, MO, NY, US); Tapantí Hydroelectric project, wet road bank, 13 Dec 1975, *Utley 3623* (CR, DUKE, F, MO). **PANAMA. Chiriquí:** Fortuna, camino de quebrada Bonita llegando por el embalse hacia el norte, 1130–1150 m, 8 Apr 1987, *Valdespino et al. 631* (DUKE, NY) [JLL thinks *Valdespino 631* may be *V. luteynii*]; Gualaca-Fortuna Dam site road, 10.1 mi NW of Los Planes de Hornito, 1260 m, 10 Apr 1980 (fl), *Antonio 4194* (MO).

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REFERENCES

Almeda, F. and D.E. Breedlove. 1992. A new *Vaccinium* (Ericaceae: Vaccinieae) from Guerrero, Mexico. Brittonia 44:50–53.

Baker, P.C. 1970. A systematic study of the genus *Vaccinium* sect. *Polycodium* (Raf.) Sleumer, in the southeastern United States. Unpublished Ph.D. dissertation, University of North Carolina, Chapel Hill.

Camp, W.H. 1942. On the structure of populations in the genus *Vaccinium*. Brittonia 4:189–247 [discussion of *V. caespitosum*, pp. 214–216]

Kron, K.A., W.S. Judd, P.F. Stevens, D.M. Crayn, A.A. Anderberg, P.A. Gadek, C.J. Quinn, and J.L. Luteyn. 2002. Phylogenetic classification of Ericaceae: Molecular and morphological evidence. Bot. Rev. 68:335–424.

Luteyn, J.L. 1976. Notes on neotropical Vaccinieae (Ericaceae). I. *Gonocalyx* - a genus new to Central America. Brittonia 28:37–41.

Luteyn, J.L. 1987. New species and notes on neotropical Ericaceae. Opera Bot. 92:109–130.

Luteyn, J.L. and R.L. Wilbur. 2005. Ericaceae. In: Wm. Burger, ed. Flora Costaricensis. Fieldiana, Bot. N.S., no. 45:i–vi, 1–107.

Nuttall, T. 1843. Description and notices of new or rare plants in the natural orders Lobeliaceae, Campanulaceae, Vaccinieae, Ericaceae, collected in a journey over the continent of North America, and during a visit to the Sandwich Islands, and Upper California. Trans. Amer. Philos. Soc. Ser. 2. 8:251–272.

Powell, E.A. and K.A. Kron. 2003. Molecular systematics of the northern Andean blueberries (Vaccinieae, Vaccinioideae, Ericaceae). Int. J. Plant Sci. 164:987–995.

Sleumer, H. 1936. Die Arten der Gattung *Vaccinium* in Zentral- und Südamerika. Notizbl. Bot. Gart. Berlin-Dahlem 13:111–140.

Sleumer, H. 1941. Vaccinioideen-Studien. Bot. Jahrb. Syst. 71:375–510.

Smith, A.C. 1932. The American species of Thibaudieae. Contr. U.S. Natl. Herb. 28:311–547, p1.1–19. [*Gonocalyx* pp. 352–355.]

Standley, P.C. 1920–1926. Trees and shrubs of Mexico. Contr. U.S. Natl. Herb. 23:1–1721. [*Polycodium* and *Vaccinium* pp. 1101–1103].

Standley, P.C. and L.O. Williams. 1966. Ericaceae. Flora of Guatemala. Fieldiana, Bot. 24(pt. 8, no. 2):88–127.

Stevens, P., J. L. Luteyn, T. Oliver, et al. 2004. Ericaceae. In: K. Kubitski, ed. The families and genera of vascular plants, vol. VI. Springer-Verlag, Berlin & New York. Pp. 145–194.

Vander Kloet, S.P. 1985. On the generic status of *Symphysia*. Taxon 34:440–447.

Vander Kloet, S.P. 1988. The genus *Vaccinium* in North America. Research Branch. Agric. Canada Publ. 1828. xi + 1–201.

Vander Kloet, S.P., J.L. Baltzer, J.H. Appleby, R.C. Evans, and D.T. Stewart. 2004. A re-examination of the taxonomic boundaries of *Symphysia* (Ericaceae). Taxon 53:91–98.

Wilbur, R.L. and J.L. Luteyn. 2005. Three previously undescribed species of Vaccinium (Ericaceae) from Costa Rica and Panama. Sida 21:1607–1614.

Williams, L.O. 1965. Tropical American plants, VII. Fieldiana: Bot. 31:167–174.